PRE-INVESTMENT DIAGNOSTIC REPORT ON THE PRUT RIVER BASIN: UKRAINE, MOLDOVA, AND ROMANIA

WASH Field Report No. 424
September 1993

WATER AND SANITATION for HEALTH PROJECT

Sponsored by the U.S. Agency for International Development
Operated by CDM and Associates

WASH Field Report No. 424

PRE-INVESTMENT DIAGNOSTIC REPORT ON THE PRUT RIVER BASIN: UKRAINE, MOLDOVA, AND ROMANIA

Prepared for the Office of Health,
Bureau for Research and Development,
U.S. Agency for International Development,
under WASH Task No. 460

by

Donald Cullivan
Tarik Pekin
Daniel Edwards
and
Timothy Bondelid

September 1993

Water and Sanitation for Health Project
Contract No. 5973-Z-00-8081-00, Project No. 936-5973
is sponsored by the Office of Health, Bureau for Research and Development
U.S. Agency for International Development
Washington, DC 20523

RELATED WASH REPORTS

Point Source Pollution in the Danube Basin: Report on Data Management, Institutional Studies, and Priority Projects. Volume I. July 1992. Field Report No. 374. Prepared by Robert Thomas, Max Clark, Tim Bondelid, Dan Edwards, William Lord, and Tarik Pekin.

Water Quality Pre-Investment Studies in Four Danube River Tributary Basins. Summary Report. July 1993. Field Report No. 407. Prepared by Jim McCullough, David Horsefield, Tarik Pekin, Max Clark, Dave Laredo, Bill Hogrewe, and Tim Bondelid.

Water Quality Pre-Investment Studies in the Yantra River Basin in Bulgaria. August 1993. Field Report No. 408. Prepared by Max Clark, Dave Laredo, and Bill Hogrewe.

Water Quality Pre-Investment Studies in the Sajo-Hernad Basin in Hungary. August 1993. Field Report No. 409. Prepared by Jim McCullough, David Horsefield, and Tarik Pekin.

Water Quality Pre-Investment Studies in the Arges Basin in Romania. August 1993. Field Report No. 410. Prepared by Max S. Clark III, David Laredo, and William Hogrewe.

Water Quality Pre-Investment Studies in the Hornad Basin in Slovakia. August 1993. Field Report No. 411. Prepared by Jim McCullough, David Horsefield, and Tarik Pekin.

CONTENTS

APPENDIXES

FIGURES

TABLES

ABOUT THE AUTHORS

Donald Cullivan, P.E., is an environmental engineer with over 35 years' experience in consulting engineering, almost wholly devoted to the planning, assessment, and institutional development of the water and wastewater sector. Most of his experience has been in developing countries in all parts of the world, with seven years as an overseas resident. In the past two years he has completed assignments in five countries of Eastern Europe and the former Soviet Union.

Tarik Pekin, P.E., Senior Environmental Engineer, Camp Dresser & McKee International Inc., has over 20 years' experience in the environmental engineering and planning field, including feasibility studies, environmental impact studies, process selection, process control, design, plant start-up and operator training, project and construction management. His work ranges from basin-wide and multinational environmental studies to specialized process engineering for the treatment of water and wastewater. Mr. Pekin has project experience in Turkey, Eastern Europe, Egypt, and Taiwan. He has written technical papers and made presentations on environmental quality issues and technologies in Turkey, Taiwan, and the United States.

Dan Edwards has been with Training Resources Group since 1981. He has over 25 years' experience as a training and organizational development consultant in Latin America, Asia, and the Middle East. He has worked on numerous WASH assignments over the past nine years, primarily in the area of training and institutional development. Mr. Edwards has been heavily involved in projects in Sri Lanka, Ecuador, Thailand, and Egypt, and has lived in the Dominican Republic and Panama.

Timothy Bondelid is a research environmental engineer with the Center for Environmental Analysis, Research Triangle Institute. He has been involved over his career as an environmental engineer in computer modeling, data quality and reliability analysis, development of environmental databases, and mapping of hydrologic systems.

ACRONYMS AND ABBREVIATIONS

Note: M = Moldova, R = Romania, and U = Ukraine

AGeoM	State Association of Production and Investigation of Geology and Topographic and Geodesic Surveys (M)
A.I.D.	U.S. Agency for International Development (Washington)
APE	Agency for Protection of the Environment (R)
AR	Apele Romane (R); similar to Aqua, Moldova; and SCWRU, Ukraine
Aqua	Water Consortium Aqua (M)
BOD	biochemical oxygen demand
DEMDESS	Danube Emissions Management Decision Support System
DEP	State Department of Environmental Protection and Natural Resources (M)
DO	dissolved oxygen
EI	Ecological Inspectorate
ha	hectare
Hydromet	State Committee for Hydrometeorology (U) Hydrometeorology Research Institute (M)
ICPA	Research Institute for Agricultural Production (R)
kg	kilogram
km	kilometer
l	liter
m	meter
mm	millimeter
MAC	maximum allowable concentration
MEP	Ministry of Environmental Protection (U)
MCS	Ministry of Community Services and Utilization of the Housing Fund (M)

mg	milligram
mg/l	milligrams per liter
m^3	cubic meters
m^3/sec	cubic meters per second
MOA	Ministry of Agriculture (U) Ministry of Agriculture and Food Industry (M)
MOH	Ministry of Health (M,U)
NGO	Nongovernmental organization
O&M	operation and maintenance
PC	personal computer, IBM compatible
PCU	Program Coordination Unit of the Danube Environmental Program (Brussels, Belgium)
RAJAC	Regia Autonomous Judet Aqua and Canalization (R) (State Autonomous Regional Water and Sewerage Agency)
SCWRU	State Committee for Water Resources of the Ukraine
SCHCS	State Committee for Housing and Community Services (U)
SHC	Scientific Hygiene Center (U)
SIU	Sanitary Inspection of Ukraine
TDS	total dissolved solids
ug	microgram
USAID	U.S. Agency for International Development (overseas mission)
WASH	Water and Sanitation for Health Project
WRM	Water Resource Management Section

RATES OF EXCHANGE (April 1993)

Moldova: US $1.00 = 820 rubles or coupons (both are used, tied to the Russian ruble)

Ukraine: US $1.00 = 2,925 coupons

Romania: US $1.00 = 627 lei

EXECUTIVE SUMMARY

Project Description

The Danube Program Coordination Unit requested that the U.S. Agency for International Development (A.I.D.) fund a diagnostic study of the Prut River basin (see Figure 1) as part of the overall Danube Environmental Program. A.I.D.'s Newly Independent States Bureau funded the study, with the cooperation of the Europe Bureau. The Water and Sanitation for Health (WASH) Project was selected to conduct the study.

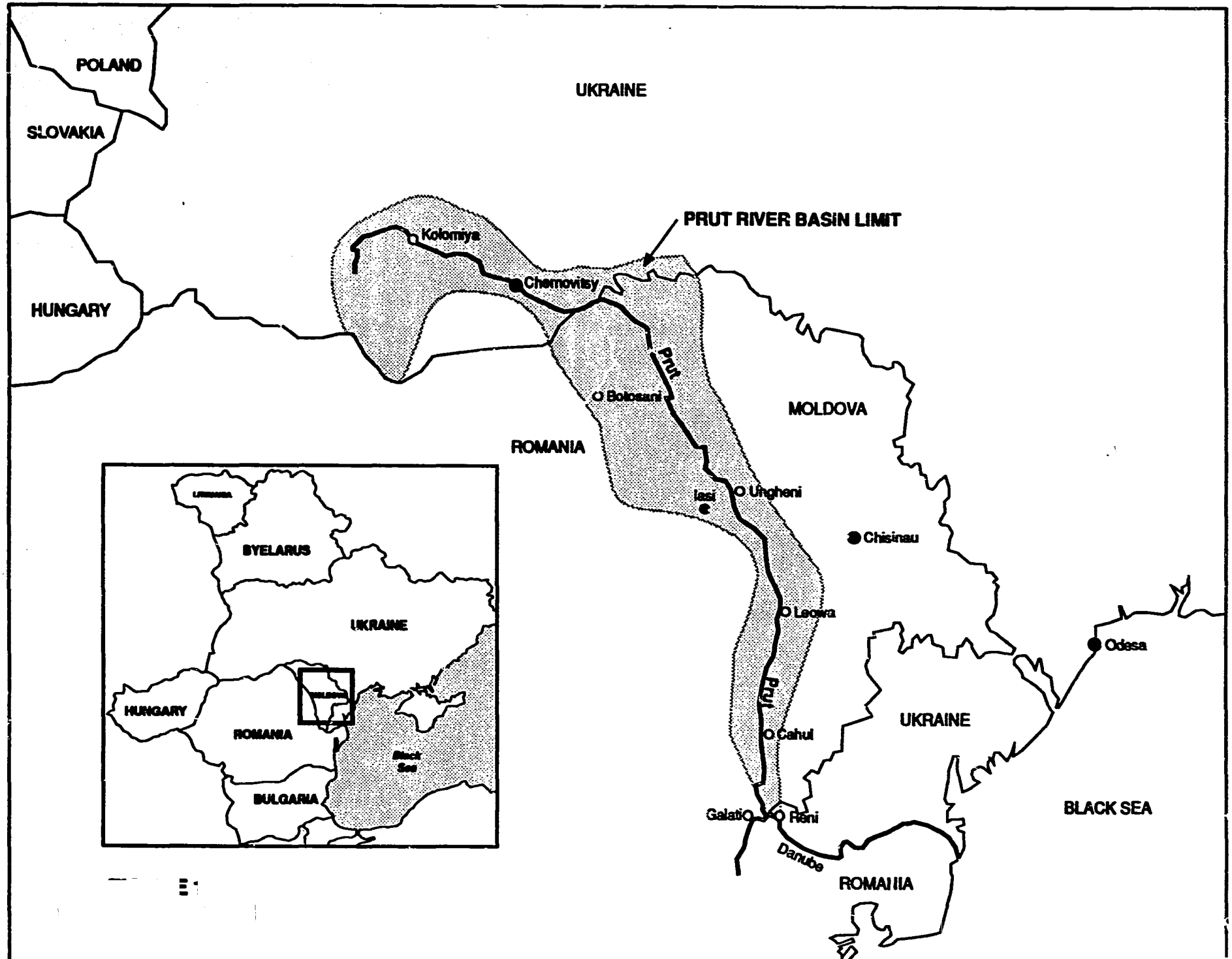
The study is meant to serve as a guide for the preparation of a pre-investment feasibility study for projects to reduce pollution and improve the environment in the three countries of the Prut River basin: Ukraine, Moldova, and Romania. The scope of work included these principal objectives:

- Determine the principal agencies in the three countries with responsibility for the environment, water quality, and pollution in the basin; review the institutional aspects affecting entities that monitor pollution and those that generate it.
- Identify, collect, and assess data relevant to pollution in the basin. Include an inventory of point-source discharges and recommendations about nonpoint pollution sources.
- Analyze and verify the quality and consistency of the data collected, and evaluate the relative impact of pollution sources on both the Prut River basin and the Danube.
- Identify major polluters that could serve as candidates for the development of investment programs, and make other recommendations for pollution control in the basin.

Findings

Basin description. With a length of 970 km, the Prut River includes 27,500 km^2 in its drainage basin. The river rises in the Carpathian mountains of Ukraine and then becomes the border between Romania and Moldova. About 3 million people live in the basin, an area largely devoted to agricultural purposes. For the most part, industry is limited to areas around the two largest cities in the basin: Iasi, in Romania, and Chernivtsy, in Ukraine.

Background. For almost five decades, policies in Ukraine, Moldova, and Romania favored industrial and agricultural development, with little concern or attention paid to related water pollution problems. In the period of economic and political restructuring since independence, funding for water pollution control and environmental cleanup has been extremely limited. The hierarchy of priorities has subordinated environmental concerns to pressing political and socioeconomic problems that all three countries now face.


POLAND
SLOVAKIA
UKRAINE
HUNGARY
PRUT RIVER BASIN LIMIT
Kolomiya
Chernovtsy
Prut
Botosani
MOLDOVA
ROMANIA
Iasi
Ungheni
Chisinau
Leova
Odesa
Prut
Cahul
UKRAINE
BLACK SEA
Galati
Reni
Danube
ROMANIA
BYELARUS
UKRAINE
HUNGARY
ROMANIA
Black Sea
BULGARIA

Such a policy places a heavy burden on the environmental agencies of these countries, coupling insufficient funds for water pollution control with a governmental posture that favors industrial and agricultural production and de-emphasizes enforcement of cleanup regulations affecting these enterprises. Government policymakers need to understand that deferral of environmental protection measures can undermine the economic growth achieved by ignoring effective water pollution control.

Institutional development. The environmental agencies of all three countries—ministries in Ukraine and Romania, and a parliamentary state committee in Moldova—have been created since independence. They were formed principally by combining former ministries or ministry departments responsible for water pollution control or related areas into a new environmental agency, with new departments created as appropriate. Overlapping with other agencies is a problem.

Some of these agencies have undergone frequent leadership changes, and some appear to lack the full support of their governments. Although new or existing legislation appears to provide strong support for environmental protection, enforcement is weak in all three countries. At present, fines and penalties are so low that it is less expensive for polluters to pay the penalties than to undertake effective pollution control.

Nonpoint-source pollution. In the basin, nonpoint-source pollution stems primarily from runoff laden with fertilizers, pesticides, and herbicides and from inadequately treated animal feedlot wastes. Solid wastes and air pollution are not considered significant water pollution sources in the three countries. Nonpoint-source pollutants do not appear to be a major source of pollution of the Prut River; however, they probably contribute to the high nitrate levels found in shallow groundwaters in Romania and Moldova. The serious health problems in the Moldovan portion of the basin may relate to the high application rates of pesticides and fertilizers there.

Point-source pollution. Pollution discharging directly to rivers comes mainly from inadequately treated municipal and industrial wastewaters in a few cities in Ukraine and Romania. The principal sources are Iasi, in Romania, and Chernivtsy, in Ukraine—the two largest cities in the basin. Another significant pollution source is poorly treated wastewater from a large pig farm just outside Iasi, Romania. There are no cities with a population over 50,000 nor any significant industry on the Moldovan side of the Prut basin.

River water quality. Despite the pollution loads from Chernivtsy, the Prut's water quality is fairly good as it leaves Ukraine because of the high self-purification capacity with respect to biodegradable organic wastes. Heavy metals in inadequately treated wastewater from plating plants are a problem, however. Located behind a dam on the Prut in northern Moldova, the Stinca Reservoir acts as a substantial sedimentation basin. From that point, water quality in the Prut is quite good until it deteriorates where the Jijiz River, the tributary carrying pollution from Iasi, discharges into the Prut. Even below that point, however, dissolved oxygen levels rarely are lower than 4 mg/l, and dissolved solids remain below 500 mg/l in all reaches.

Water usage. Chernivtsy obtains some of its water from the Prut through bank-filtered water supplies, while Iasi obtains most of its water from the Stinca Reservoir. Some of the smaller cities in the three countries also use the Prut as their principal source of raw water. However, most people who live in the basin obtain their water from shallow wells.

Impact of the Prut on the Danube. At the point of their confluence, the median flow of the Prut River represents only 1.5 percent of the total median flow of the Danube. In addition, the Prut's water quality is significantly better at that point than the Danube's. Accordingly, the waters of the Prut have negligible impact on the Danube.

Assessment of data collected. Considerable data are available that the WASH team was unable to collect, and the accuracy and completeness of some of the data collected may be suspect. Nevertheless, the amount and quality of the data obtained appears adequate for the purpose of the study.

Conclusions and Recommendations

The conclusions and recommendations of the study are presented in Chapter 5. Possible investment projects or further studies for each of the three countries are described, with an indication of priority. Institutional improvements also are identified.

Priority projects for the Ukraine include the municipal wastewater treatment plant in Chernivtsy and other pollution-producing plants.

In Romania, the Iasi municipal wastewater treatment plant is overloaded and outmoded and is, therefore, identified as a priority project. Other projects include proper treatment of wastes from 270,000 pigs, of air pollution from the coal-burning thermal power plant, and of solid waste pollution from the open garbage and trash dump all located in the Tomesti area.

Moldova's priority project is the disposal of environmentally unacceptable pesticides currently stored at over 50 locations. In addition, wastes from about 30 animal farms need to be treated satisfactorily.

Recommended institutional improvements relate to major issues common to Ukraine and Moldova. These issues include the lack of authority of environmental agencies, unclear national policy and responsibility for environmental protection, unrealistic wastewater treatment standards, and inadequate pollution monitoring. Unless most of the issues are resolved, pollution reduction in the Prut River will be hindered.

Chapter 1

INTRODUCTION

1.1 Background: Danube Environmental Program

The easternmost significant tributary[1] of the Danube River, the Prut enters the Danube about 150 kilometers upstream from the point where the various mouths of the Danube discharge to the Black Sea. In accordance with the recommendations of the Bucharest Declaration of 1985, riparian countries of the Danube have been cooperating on a water-quality monitoring program. This program was endorsed in June 1991, and confirmed at the Danube Basin Conference in September 1991. A permanently staffed Danube Program Coordination Unit, established in Brussels, Belgium, in February 1992, coordinates and aids the implementation of program objectives.

Principal entities responsible for the program include the following:

Major riparian countries: Austria, Bosnia, Bulgaria, Croatia, Czech Republic, Germany, Hungary, Moldova, Romania, Slovenia, Slovak Republic, and Ukraine.

Participating development funding institutions: Commission of the European Communities, European Bank for Reconstruction and Development, European Investment Bank, Global Environmental Facility[2], Nordic Investment Bank, and development agencies of the Netherlands and the United States.

Selected nongovernmental organizations (NGOs): Cousteau Foundation, Regional Environmental Center, World Conservation Union, and the World Wildlife Fund for Nature.

Representatives from these entities form a task force that participates in periodic meetings organized by the permanent staff of the Program Coordination Unit.

The program has two basic objectives: to develop a strategic action plan to improve the Danube's water quality and to implement that plan. Initial activities of the first phase are to conduct reconnaissance or diagnostic studies and collect data in the various subbasins of the Danube. This report on the Prut River basin, funded by the U.S. Agency for International Development (A.I.D.), is one component of these initial activities.

---

[1] Danube Subbasin No. 46, according to Sikora, Urge, and Miklos, *Hydrology of the River Danube*, Priroda Publishing House, Bratislava, 1988.

[2] Jointly managed by the United Nations Development Program, the United Nations Environmental Program, and the World Bank.

1.2 Scope of Work

The scope of work for this diagnostic study sets forth these objectives:

- Identify, collect, and assess data relevant to a management program for the Prut River basin.
- Conduct an inventory of point-source discharges.
- Review institutional aspects affecting entities responsible for generating or monitoring pollution.
- Analyze and verify the quality and consistency of data collected.
- Evaluate the relative impact of the pollution sources.
- Coordinate efforts with relevant officials of the riparian countries of the Prut River, and with U.S. officials in these countries.
- Evaluate the consequences of nonpoint-source pollution.
- Make recommendations for better pollution control in the Prut River basin.
- Identify pollution sources that could serve as candidates for the development of investment programs.

Initially, Romania was not included in the scope of work because that country had been extensively studied under other phases of the Danube Program. Ultimately, however, it was agreed that the WASH team would also investigate pollution sources on the Romanian side of the river. Because public health and institutional issues in Romania had been addressed in earlier studies, they were not included in the enlarged scope.

1.3 Team Activities

The WASH team included an environmental engineer/institutional development specialist, an engineer/computer data management specialist, an environmental/industrial engineer, and a management/institutional development specialist. Augmenting team skills were local environmental engineers from Romania and Moldova. All team members have extensive experience in water resources and water pollution issues and/or institutional aspects of water and wastewater utilities and agencies in Eastern Europe, Russia, and republics of the former Soviet Union; most had taken part in previous studies related to the Danube Program.

After three days of planning that included officials from the World Bank, A.I.D., and other agencies interested in the Danube Program, the team spent three weeks in Ukraine, Moldova, and Romania (April 18 to May 7, 1993). There, they met with officials, collected data, and made field visits to the river basin, point sources of pollution, and other places of interest.

During visits to roughly 35 agencies or departments, eight water or wastewater treatment plants, and six laboratories, the team spoke with about 60 officials. The team also made two-

day tours of the countryside within the basin drainage area, one on the Moldovan side of the river and the other on the Romanian side. (A list of officials and agencies visited is provided in Appendix A.)

During the second phase, two team members returned to Ukraine and Moldova (July 14-21, 1993) to verify data, collect additional information, and discuss tentative findings with relevant officials. This trip concluded with a visit to Brussels to discuss preliminary findings with Danube Program Coordination Unit officials.

Chapter 2

EXISTING CONDITIONS IN THE BASIN

2.1 Topography

The Prut River rises in the Carpathian mountains in the southwestern corner of Ukraine, relatively close to the Romanian border. Flowing generally east before leaving Ukraine, the river then descends to become the border between Moldova and Romania. It discharges into the Danube at the southernmost tip of Moldova, where Ukraine, Romania, and Moldova join. The Danube then flows another 150 km or so to its destination in the Black Sea. This portion of the basin is typical delta land, however, and the Danube divides into several streams before reaching the Black Sea. (See Figure 1.)

The Prut River is about 967 km long, a figure that varies slightly among estimates. Of the total length, 251 km lie within Ukranian territory, and another 31 km form a border between Ukraine and Romania. The remaining 685 km form the only border between Romania and Moldova. According to government information and WASH estimates, the total drainage area of the Prut is about 27,500 km^2: Ukraine accounts for 8,300 km^2, Moldova for 8,200 km^2, and Romania for 11,000 km^2. The drainage area is relatively narrow, averaging less than 30 km in width.

Traversing its first 190 km in Ukraine, the Prut falls about 1,400 meters through the mountainous regions until it reaches Chernivtsy. After that, the river slows and drops only about 150 meters along the entire border (685 km) between Romania and Moldova, a slope of 0.020 percent. The Moldova-Romania section of the basin is characterized by rich, rolling farmlands over most of the area.

2.2 River Network

The primary tributaries of the Prut and the water-sampling stations on the river are listed in Table 1. The river kilometers (km) given in the table refer to the stations on the Prut where the tributaries enter or where sampling stations are located. Further data are under preparation by the Chernivtsy Environmental Protectorate and should be available for the pre-investment study consultant.

Table 1

Prut River Network and Sampling Stations

KM	COUNTRY	TRIBUTARY	SAMPLING STATION	COMMENT
967	Ukraine			River Source
915	Ukraine		0.5 km U/S Yaremtcha	
914	Ukraine		Yaremtcha	City of Yaremtcha
877	Ukraine		0.5 km U/S Kolomiya	
876	Ukraine			City of Kolomiya
875	Ukraine		0.5 km D/S Kolomiya	
780	Ukraine		3.5 km U/S Chernovitsi	
776	Ukraine			City of Chernovitsi
773	Ukraine		3.0 km D/S Chernovitsi	
764	Ukraine		7.0 km D/S Chernovitsi	
716	Romania/Ukraine			Border
713	Romania	Poina		
710	Romania/Ukraine		Oroftiana-N. Sulita	
691	Romania	Cornesti		
685	Romania/Moldova			Border
668	Moldova	Zelenaia		
665	Moldova	Medvedca		
659	Romania	Isnovat		
658	Romania/Moldova		Radauti-Lipcani	
656	Romania	Radauti		
656	Moldova	Larga		
637	Moldova	Vilia		

618	Moldova	Lepatinca	
608	Romania	Ghireni	
596	Moldova	Racovat	
582	Moldova	Juliet S. Recovat	
580	Romania	Volorat	
573	Romania	Badu	
558	Moldova	Ciugur	
536	Romania-Moldova		Stinca-Costesti
526	Romania	Baseu	
512	Romania	Crogea	
499	Romania	Berza Veche	
489	Moldova	Camenca	
487	Romania	Riiosa	
479	Romania	Luncanilor	
466	Moldova	Malii Soret	
410	Moldova	Girlasor	
399	Moldova	Vladnic	
395	Romania-Moldova		Sculeni-Sculeni
385	Moldova	Delia	
376	Romania-Moldova		Ungheni-Ungheni
367	Moldova	Ileni	
353	Romania-Moldova		Prisecani-Valea Mare
348	Moldova	Bratuleanca	
339	Moldova	Polduresti	
325	Moldova	Grosesti	
305	Romania	Jijia	
298	Romania	Bohotin	
298	Romania	Mosna	
292	Romania-Moldova		Albita-Leuseni

278	Moldova	Linova		
272	Moldova	Golmasni		
239	Moldova	Gura-Lapusna		
226	Romania	Prutet		
225	Romania	Berezeni		
225	Moldova	Sirma		
196	Moldova	Barata		
154	Romania	Boul Batrin		
152	Romania-Moldova		Falciu-Stoianovca	
152	Moldova	Tigeci		
147	Romania	Copeceana		
138	Romania	Balciug		
138	Moldova	Ses		
129	Moldova	Larga		
103	Romania	Elan		
86	Romania	Horincea		
78	Romania	Oancea		
78	Romania-Moldova		Oancea-Cahul	
69	Moldova	Valca-Galnasci		
0				Danube

2.3 Population and Municipalities

Reliable population data for the basin were difficult to obtain. In general, there are few large cities in the drainage area. Chernivtsy, at about 260,000, is the largest in Ukraine; Kolomyia, 100 km upstream, has a population of 70,000. However, a sizable number of cities and towns in the 10,000 to 50,000 range are situated in the Ukraine portion of the Prut basin. In the absence of official numbers, the Ukrainian population living in the basin is estimated roughly at about 800,000 people, based on the assumption that population density in the basin approximates the national average.

With about 450,000 people, Iasi, Romania, is the largest city in the entire Prut River basin.[3] The city of Botosani has a population of 130,000 and several other fairly sizable Romanian cities and towns lie in the drainage area. Romanian authorities estimate that 1.4 million Romanians live in the basin.

No large Moldovan cities are found in the basin. Cahul and Ungheni, two of the largest, have populations of slightly over 40,000. The WASH team roughly estimates that 400,000 Moldovans live in the basin, a population residing in the two cities just mentioned, 10 towns (or "urban centers"), and 220 villages. Roughly, therefore, the total population within the Prut River basin is about 2.5 to 3 million. It must be emphasized, however, that this is only a rough estimate, as little data were available in any country on population by river basin.

2.4 Land Use and Development

In the Prut River basin, land is used predominantley for agriculture and animal husbandry, with some areas in Ukraine and Romania devoted to industrial activity. Summaries of development patterns in each of the three countries follow.

Ukraine

In Ukraine, the 8,300 km^2 drainage area of the Prut River amounts to less than 1.4 percent of the country's total land mass (603,700 km^2), and is located in its southwestern corner. The Chernivtsy *Oblast*, the region in which lies most of the Prut River basin in Ukraine, reports a total of 75 "significant" polluters within its borders.[4] Of these, 11 were municipal wastewater treatment plants, 62 were industries, and the other two were sugar beet processing plants. The 62 industries include only those discharging wastes directly to the Prut River (after treatment); industries discharging their wastes to municipal treatment plants (with or without preliminary treatment) are not included. Outside the large cities, most of the Prut River basin land in Ukraine is agricultural.

---

[3] The 1992 Romanian Statistical Yearbook lists the population at 343,000, but that represents only registered population with identity cards. Local officials believe 450,000 is a more realistic estimate.

[4] Mr. Victor Motovilin, Head, Chernivtsy Regional Inspectorate of the Ministry of Environmental Protection.

Moldova

Most of Moldova's 8,200 km^2 in the basin are devoted exclusively to agricultural development. The relatively small size of Moldovan cities in the basin (only two of around 40,000) and the distance of the region from the larger urban centers to the east tend to limit industry to the light category. No Moldovan officials cited industrial wastes as a problem along the Prut. Visual inspection of much of the valley indicated the widespread presence of agricultural and animal farms and the near absence of any industry of consequence, with the exception of some food processing facilities. Animal husbandry is widely practiced, although generally on a modest scale: about nine large pig farms, averaging 22,000 pigs each; 14 cattle farms, averaging 3,000 head; and seven poultry farms, averaging 185,000 birds. (These estimates from a Moldovan official.[5])

Romania

Romania's 11,000 km^2 of the Prut River basin include a mixture of industry and agriculture. The city of Iasi, with a population of 450,000, has significant heavy industry, and a pig farm with about 270,000 pigs[6] operates in the Tomesti area (outside Iasi). This area is the principal center of industrial activity in the Prut River basin. There is also some industrial development associated with the city of Botosani (population 130,000) in the north, but most of the rest of the Romanian basin's agricultural character is similar to that in Moldova.

2.5 Environmental Situation

As this study focused almost entirely on water pollution in the Prut River basin, solid wastes and air pollution were not studied. Observations within the region, however, indicate that these are not serious contributors to environmental problems in the Prut basin.

The relatively minor level of industrial development and the paucity of large cities in the basin appear to create less air pollution than in other parts of the three countries, or in the Danube basin as a whole. (A possible exception is Iasi, Romania.)

The quality of river water is first affected in the area of Chernivtsy, Ukraine, but improves considerably by the time it reaches the Moldovan border. At least some of this improvement results from the high degree of oxygenation occurring in the river during its steep descent within Ukraine to the border. By most normal standards, the river's water quality is fairly good throughout much of its length between Moldova and Romania. As a fenced and guarded international border, the river is little used for recreational purposes or for fishing.

---

[5] Mr. Nicolai Paholco, Animal Farm Waste Specialist, Ministry of Agriculture.

[6] The IPCA Institute lists the pig population at 145,000, while local officials in Iasi said there were 400,000 pigs at the site. The figure of 270,000 was used in this report on the basis of the 1992 PROED S.A. Project of the Iasi Municipal Wastewater Treatment Plant.

Ukraine

Within Ukraine, the Prut is contaminated by inadequately treated wastewaters, both domestic (in Chernivtsy and other medium-sized cities) and industrial. The latter group includes metal plating wastes and effluents from two large sugar processing plants. This level of contamination degrades the quality of raw waters taken from the Prut for use as municipal water supplies, particularly downstream from Chernivtsy.

Moldova

Within Moldova, the principal environmental concerns in the basin relate to the overuse of pesticides, fertilizers, and herbicides. This subject is discussed in Section 2.8. Little direct, hard data exist as yet on the impact these high application rates have had on groundwaters, on river water quality, or on public health. Nitrate levels in the shallow wells used by most Moldovans living in the Prut basin are high. Over the past five years, the number of wells with nitrates above the allowable maximum has risen from about 20 percent to 50 percent. These relatively high nitrate levels could indicate pesticidal contamination as well. Because health statistics appear to indicate problems more serious than those normally associated with high-nitrate drinking water, there also may be the presence of contaminants other than nitrates. (See Section 2.10, which discusses health issues.)

Romania

Within Romania, environmental problems are particularly noticeable and severe in the area around the city of Iasi. The following facilities are located in Tomesti, a relatively highly industrialized area on the outskirts of Iasi:

- Iasi's wastewater treatment plant;
- Pig farms;
- Central power station, which burns coal and has a too short chimney;
- Heavy industrial plants;
- Iasi's solid waste disposal site, which is little more than an open dump.

The pollution of the Bahlui and Jijia rivers, tributaries of the Prut, is such that it creates serious problems for downstream towns and villages needing an adequate water supply.

2.6 Hydrologic Conditions

The majority of the first- and second-order watercourses have permanent flows, while third- and fourth-order watercourses are partially or totally dry in summer. The long-term average annual flows in the Prut are as follows: at Ungheni, 83.5 m^3/sec, and at Leova, 89.2 m^3/sec. No data were obtained on the total mean flow of the Prut, but it is believed to be in the order of 100 m^3/sec.

In most of the basin, the climate offers moderate winters and long, hot summers. The average temperature varies from 7.7°C in the north to 9.9°C in the south of the basin. January is the coldest month, with an average temperature of minus 5.2°C in the north and minus 3.0°C in the south. The highest temperatures are observed in July, with an average of 19.5°C in the north and 21.8°C in the south. The basin is characterized by low precipitation, with average rainfall ranging from 445 mm in the south to 595 mm in the north, of which 20 to 25 percent falls in the cooler half of the year. The minimum rainfall occurs in March, and the peak in June and July.

2.7 Water Use

In this primarily agricultural basin, the Prut River is the source of both drinking and irrigation water. Clearly a lifeline, the river helps support the economy of the basin, and the health of the people depends upon it as well. Water usage by each of the three countries is described in the following sections.

Ukraine

The State Committee for Water Resources of Ukraine (SCWRU) in Kiev states that 13 million cubic meters of water was extracted from Chernivtsy area wells during 1991 (a figure equivalent to 35,600 m^3/day). The Prut and its tributaries serve as the principal water source for several cities, and meet about 30 percent of the needs of the city of Chernivtsy. In 1991, SCWRU reported total surface-water extractions of 36 million cubic meters (almost 100,000 ^{3}/day or 1.1 m^3/sec), but this includes some water from the Dneister River, probably mostly used by Chernivtsy. However, officials in Chernivtsy expect to make greater use of the Prut and less of the Dneister because of the Prut's better water quality. No information was obtained on direct extractions by industries or for irrigation.

Romania

Detailed information on the use of Prut River water in Romania is unavailable, but Iasi alone extracts about 4.6 m^3/sec. Most of this comes from the Stinca Reservoir, which has a volume of 1.3 million cubic meters, about half of it useable. Other cities in the basin probably account for about 1.5 to 2 m^3/sec from the Prut and its tributaries.

No information was obtained about extractions for irrigation use, but based on Moldovan data, it could be as much as five times the withdrawals for drinking water purposes. Details on water extractions are probably available from Apele Romane, the nearest Romanian counterpart to the SCWRU.

Moldova

Fairly detailed information was obtained on uses of the Prut River water in Moldova. Usage by broad categories (believed to be for 1992) follows:

	Million m^3/yr	m^3/sec
Irrigation	400	32.3
Municipal Water Supply	157	5.0
Fish Aquaculture	27	1.5
Total	584	38.8

There are 40 major users in Moldova, which extract 172 million m^3/yr; 17 of these extract surface water for use as municipal water supply. Moldova extracts a substantial amount of water from the Prut and its tributaries, and demand often exceeds availability during periods of reduced river flows.

2.8 Major Sources of Water Pollution

2.8.1 Point Sources

In the Prut River basin, the significant point sources are the major population centers. (Major cities and towns and their population are listed by country in Table 2.)

Population centers with significant industrial activity are Chernivtsy, in Ukraine, and Iasi, in Romania. Moldovan towns listed in Table 2 may be discharging to tributaries before discharging to the Prut. All major cities and towns in the basin tend to have municipal wastewater treatment plants and an industrial wastewater pretreatment program. Table 2 also includes some data on municipal wastewater treatment plants that were available at the time this report was prepared, and additional data are available from other sources.

The WASH team visited municipal water and/or wastewater treatment plants in Chisinau (even though not in the basin), Chernivtsy, Iasi, and Ungheni. In general, although the municipal treatment plants are of poor quality, they provide reasonable treatment efficiency at the cost of considerable operator effort. However, the effectiveness of industrial pretreatment and treatment programs varies, and appears to be inadequate in many cases.

In Chernivtsy, the major industries are machinery and metal working, food processing, woodworking, and paper. Most of these industries are connected to the city sewerage system. Heavy metals from these industries degrade the river's water quality.

Table 2

Prut Basin Population Centers

Country	City or Town	Population	WWTP Effluent m3/d (BOD5)	Receiving Stream
Ukraine	Chernevitsi	261,200	120,000	Prut
	Kolomiya	67,500		Prut
	Yaremtcha			Prut
Romania	Iasi	450,000		Bahlui/Jijia
	Botosani	126,000		Jijia
	Husi	33,000		Elan/Prut
	Tirgu Frumos	14,000		Bahlui
	Saveni	9,000		Baseu
Moldova	Cahul	44,300	13.7 (40)	
	Ungheni	39,400	10.0 (10)	
	Edinet	19,700		
	Falesti	19,200		
	Nisporeni	16,100	2.7 (40)	
	Glodeni	13,400	10.0	
	Leova	12,200	4.8 (7)	
	Briceni	11,300		

Iasi, Romania, is also an industrial center with plants manufacturing such products as electrical and electronic products, machinery, textiles, wood products, furniture, and pharmaceuticals (mainly antibiotics). The previously noted pig farm in Tomesti has 270,000 animals. Marginally treated at best, the wastewaters from this farm are discharged to the Iasi municipal sewerage system. In terms of organic waste production, this farm increases Iasi's population equivalent to about 1 million, making this city a clear "hot spot."

The industries in the Moldovan part of the basin are very limited and have little effect on point-source pollution of the Prut River.

Wastes from animal farms can be point or nonpoint sources of pollution. As most appear to fall under the category of nonpoint, they are described in the following section.

2.8.2 Nonpoint Sources

Animal Farm Wastes

For all three countries, the principal land use in the Prut River basin is agricultural, and pollution from agricultural activities is a source of concern. Animal farms, important in the basin, tend to be scattered throughout all three countries. Most of them probably constitute nonpoint-pollution sources. In Moldova, animal farms are supposed to create zero discharge to surface waters by treating and recycling their wastes to agricultural land. Because of the zero discharge requirement, these farms are not under the control of any point-source control authority, even though they may produce point discharges to water bodies. Table 3 summarizes data on the largest farms in Moldova on the basis of their wastewater generation.

Table 3

Large Farms in Moldova

Town	Rayon	Type	No.of Animals	Waste-water m^3/day	WW Treat. m^3/day	Lagoon	Land Application (hectares)
Caracuseni	Briceni	Pig	30,000	250	1,600	Yes	250
Cahul	Cahul	Pig	26,000	600	1,200	Yes	
Cantemir	Cantemir	Pig	14,000	220	---	Yes	
Baimaielia	Cantemir	Cattle	3,200	280	---	Yes	
Mihaileni	Briceni	Cattle	2,500	250	200	Yes	290
Lipcani	Briceni	Cattle	2,400	200	200	Yes	200

Information on major animal farms in Romania was obtained from the records of the Research Institute for Agricultural Production (ICPA) in Romania. Table 4 lists names and locations, ownership, and animal population of the largest pig, cattle, and poultry farms in the basin. Information on animal farms in the Ukrainian part of the basin was not obtained.

Table 4

Animal Farms in Romania

PIG FARMS

JUDET	FARM LOCATION	OWNERSHIP	CAPACITY PER YEAR, ANIMALS	RIVER BASIN
BOTOSANI	IISCIP Leorda	State	30,000	Sitna
	Stefanesti	State	5,000	Prut
IASI	IISCIP Tomesti	State	145,000	Bahlui
	Bivolari	State	5,000	Prut
	Razboine	State	25,000	Bahlui
	Ciurea	Private	7,000	Bahlui
	Belcesti	Private	22,000	Bahlui
	Popricani	Private	20,000	Bahlui
VASLUI	AEICIP Falcui	State	45,000	Prut
	AEICIP Stanilesti	State	15,000	Prut

CATTLE FARMS

JUDET	FARM LOCATION	OWNERSHIP	CAPACITY PER YEAR, ANIMALS	RIVER BASIN
BOTOSANI	IAS Albesti	State	700	Jijia
	IAS Catamaresti	State	4,900	Sitna
	IAS Dingeni	State	3,900	Jijia
	IAS Dorohoi	State	3,800	Jijia
	IAS Seveni	State	5,700	Baseu
	Frumusica	Private	3,500	Miletin
	Miorcani	Private	3,500	Prut
	Ripiceni	Private	5,500	Prut
	Ungureni	Private	5,500	Jijia

JUDET	FARM LOCATION	OWNERSHIP	CAPACITY PER YEAR, ANIMALS	RIVER BASIN
IASI	AEVIL Tg. Frumos	State	1,400	Bahlui
	IAS Razboieni	State	5,000	Bahlui
	IAS Iasi	State	3,800	Bahlui
	IAS Copou	State	2,100	Bahlui
	IAS Miroslava	State	4,500	Bahlui
	AEVIL Bohotin	State	1,400	Prut
	AEVIL Tomesti	State	1,400	Bahlui
	AEVIL Popricani	State	5,300	Jijia
	Gropnita	Private	5,500	Jijia
	Holboca	Private	5,500	Bahlui
	Bivolari	Private	1,600	Prut
	Vladeni	Private	1,400	Miletin
	Plugari	Private	1,400	Miletin
	Popesti	Private	1,400	Bahlui
	Letcani	Private	1,400	Bahlui
	Probota	Private	1,400	Miletin
	Cristesti	Private	1,400	Bahlui
VASLUI	IAS Husi	State	6,600	Prut
	IAS Falciu	State	2,400	Prut
	IAS Vetrisoaia	State	800	Prut

POULTRY FARMS

JUDET	FARM LOCATION	OWNERSHIP	CAPACITY PER YEAR, ANIMALS	RIVER BASIN
BOTOSANI	IAS Botosani	State	1,500,000	Sitna
	IAS Catamaresti	State	830,000	Sitna
IASI	IAS Hirlau	State	770,000	Bahlui
	IAS Podu Iloaiei	State	1,920,000	Bahlui
	IAS Tg. Frumos	State	6,500,000	Bahlui
	IAS Iasi	State	160,000	Bahlui

Note: The number of animals in private farms are continuously changing and are estimated to be 50 to 60 percent of design capacity.

Pesticides and Fertilizers

In Moldova, excessive use of agricultural chemicals and, more importantly, pesticides has been a significant pollution problem in past years and may still be, despite the fact usage rates are down considerably. The residual effects of these practices on the soil and groundwater are of concern. See Figure 2 for a summary of annual pesticide consumption in Moldova from 1972 to 1992. The average pesticide application rate in the Moldovan basin in 1992 was about 5.2 kg/ha, down from a reputed past rate of over 20 kg/ha. A listing of 1992 application rates by *rayons* (small districts) appears in Table 5. The amount of pesticides stored in farms is also indicated; the nature of some of these stored pesticides and the storage conditions constitute an environmental threat to local groundwaters.

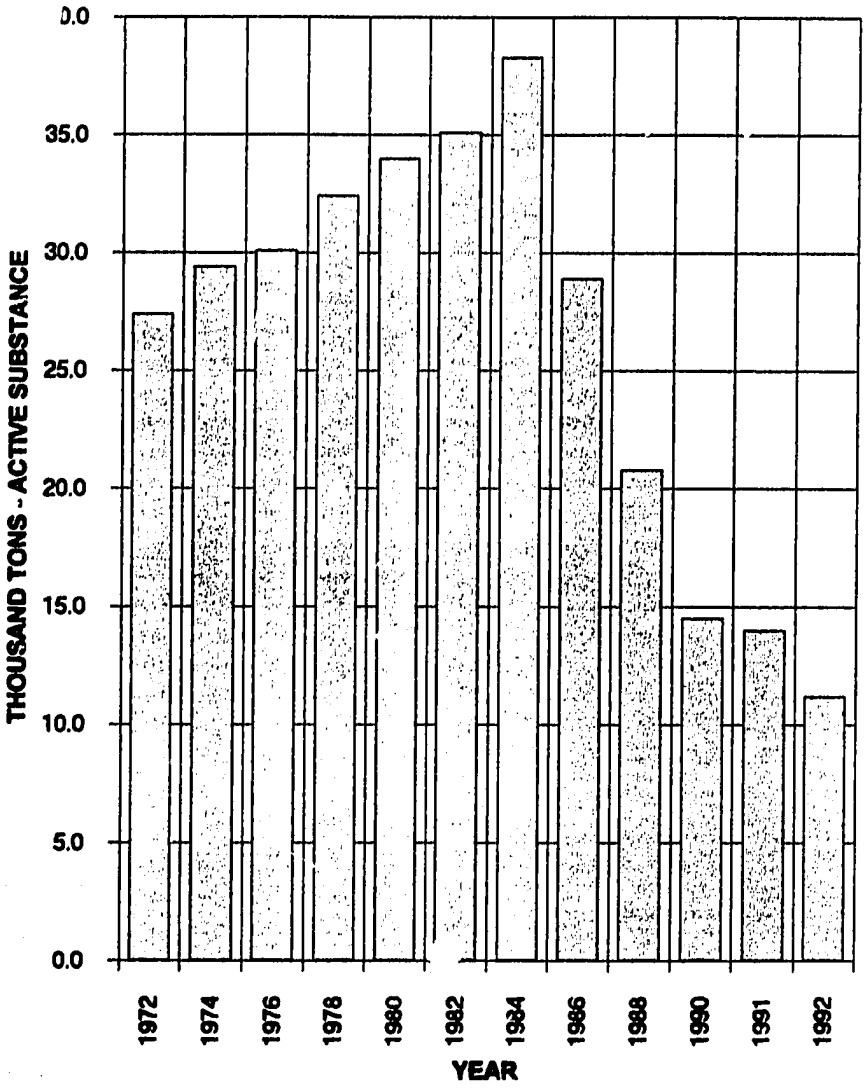


Figure 2

Annual Use of Pesticides in Moldova

Table 5

Pesticide Use and Storage in Moldova, 1992

Rayon	Kg/hectare	Tons Stored
Briceni	5.0	148
Edinet	4.0	2
Riscani	5.4	33
Glodeni	5.1	14
Falesti	3.0	2
Ungeni	5.7	--
Nisporeni	6.7	36
Hincesti	5.9	14
Leova	5.2	5
Cantemir	4.1	23
Cahul	6.4	42
Vulcanesti	5.8	15
TOTAL		334

Pesticide and fertilizer usage in Romania has always been much lower than in Moldova. In 1992, ICPA reported an overall pesticide application rate of 1.1 kg/ha. Chemical fertilizers were applied at a rate of 31 kg/ha, while natural fertilizer (mostly cattle manure) was applied at a rate of 1,100 kg/ha. No measurements of pesticides in water bodies were obtained for Romania. However, two types of pesticides (DDT and HCH) were measured in soil around Iasi, Botosani, and Galati. These are the measurements for 1989 and 1990:

Pesticides in Soil in Romania (micrograms per kilograms)

	Iasi		Botosani		Galati	
	DDT	HCH	DDT	HCH	DDT	HCH
1989	>0.1	>0.1	0.1-0.3	0.1-0.3	0.5-1.0	.0.1
1990	>0.1	>0.1	>0.1	>0.1	0.1-0.3	>0.1

Although no data were collected on pesticide and fertilizer use in Ukraine, on the basis of discussions with officials, application rates there are believed to be closer to Romania's than to Moldova's. Pesticide levels are shown in Table 6.

As indicated by water quality data related to fertilizers—such as nitrogen, phosphorus, and dissolved solids—pollution from fertilizers is of general concern in the Prut basin. According to discussions with the authorities, further evidence is found in shallow wells in the basin, although no published data were provided.

2.9 Water Quality

The next two sections describe water quality in the basin, both for the main body of the Prut River and for its tributaries. As expected, the tributaries are more severely affected than the main river because of the lower dilution capacity.

2.9.1 The Prut River

Water quality data for the Prut River in 1992 is presented in Table 7, which lists all the analysis results for conventional pollutants and also notes the river flow at the time the samples were taken. Data for additional parameters are available in the data bases.

The Ukrainian data are from a Hydromet dataset. Although no river flow data were available in this Ukrainian dataset, such information should be available from other sources. The Chernivtsy Environmental Protectorate is preparing a comprehensive environmental dataset for this project, which should be of considerable value.

Figures 3 to 7 indicate water quality profiles of the Prut River for conventional pollutants, based on the data of Table 6. These graphs clearly show the Chernivtsy and Iasi areas as having the highest pollutant loads for most parameters. Data for the Romanian and Moldovan reaches of the Prut are from the Iasi regional office of the Romanian Agency for Environmental Protection. This office appears to be the focal point for the Romanian and Moldovan joint monitoring program. Samples designated as ROM and MOL refer to samples taken by Romania or Moldova, respectively. Data for additional parameters are also available in the Romanian data base.

A review of available data shows the Prut's water quality to be generally good. Dissolved oxygen (DO) levels are quite high except for some relatively low levels observed during low-flow periods in some sections. For example, a DO level of 3.5 mg/l was observed in one sample taken at the point where the tributary Jijia, carrying the Iasi discharges, enters the Prut. Low DO levels of about 4 mg/l also have been observed at the downstream end of the Prut. Significant volumes of water are drawn from the Prut for irrigation, which, in addition to natural causes, probably reduces dilution. Data indicate that total dissolved solids (TDS) in the Prut remain below 500 mg/l, an acceptable level for most irrigation use.

Table 6

Pesticide Levels (in micrograms per liter)

LOCATION	PERIOD	DDT	HCCH[1]	ATRAZINE	SIMAZINE
Prut at Leova	1991	0.045-0.392	0.02 -0.071	0.13-0.18	0.51-3.30
Prut at Cislita	1991	0.102	0.054-0.081	0.27	1.28
Danube at Giurgiulesti	1991	0.019	0.001-0.006		
Prut at Sirauti	1980-1987	0.010-0.568	0.003-0.096		
Prut at Korpaci	1977-1987	0.077-4.092	0.003-0.097		
Prut at Costesti	1980-1987	0.090-1.119	0.005-0.990		
Prut at Branesti	1981-1987	0.02[illegible]-0.446	0.006-0.136		
Prut at Ungheni	1978-1987	0.005-0.792	0.001-1.030		
Prut at Leova	1977-1987	0.001-0.543	0.002-0.252		
Prut at Cahul	1977-1987	0.001-2.222	0.001-0.367		
Prut at Brinza	1977-1987	0.006-0.642	0.006-0.562		
Prut Tributary Ciugur at Birladeni	1977-1987	0.006-0.384	0.003-0.184		
Limits for Drinking Water:					
EPA Ambient Water Quality Criteria for 10^{-5} cancer risk level		0.00024			
EPA MCL (Maximum Contaminant Level)			0.2[1]	3.0	4.0

NOTES: 1. Analysis results reported in alpha-HCH and gamma-HCH for all periods except 1991. EPA MCL given above is for Lindane (HCCH).

Table 7

Prut River Water Quality Data, 1992

	STATION KM	STA NAME	SAMPLEID	FLOW m3/s	PHOSPHATES	AMMONIA	NITRATES_N	BOD_5	DO_MG_L	STA		
1	915	U/S Yaremtcha	HYDROMET46-920302-		0.0200	0.6200	1.7000	2.9000	10.5000	915		
2	915	U/S Yaremtcha	HYDROMET46-920423-		0.0120	0.9700	1.9500	2.9000	12.4000	915		
3	915	U/S Yaremtcha	HYDROMET46-920825-		0.0040	0.6700	1.0000	3.0000	10.5000	915		
4	915	U/S Yaremtcha	HYDROMET46-921022-			0.6200	1.6500	2.8000	10.9000	915		
5												
6	914	Yaremtcha	HYDROMET47-920302-		0.0250	0.4700	1.7500	2.8000	10.1000	914		
7	914	Yaremtcha	HYDROMET47-920423-		0.0120	1.0500	1.8500	2.8000	11.6000	914		
8	914	Yaremtcha	HYDROMET47-920825-		0.0040	0.7700	0.7500	2.5000	10.9000	914		
9	914	Yaremtcha	HYDROMET47-921022-			0.7200	1.5000	2.4900	10.5000	914		
10												
11	877	U/S Kolomiya	HYDROMET48-920225-		0.1580	1.7000	3.8000	1.7000	13.7000	877		
12	877	U/S Kolomiya	HYDROMET48-920507-		0.0280	0.7700	1.3000	4.2100	10.9000	877		
13	877	U/S Kolomiya	HYDROMET48-920720-		0.0160	0.5200	2.5500	2.1100	10.5000	877		
14	877	U/S Kolomiya	HYDROMET48-920803-		0.0040	0.6700	1.1500	2.7000	11.2000	877		
15	877	U/S Kolomiya	HYDROMET48-921006-			0.6700	1.6000	3.6800	10.8000	877		
16	877	U/S Kolomiya	HYDROMET48-921108-		0.0210	1.1000	3.9000	2.7000	11.2000	877		
17	877	U/S Kolomiya	HYDROMET48-921210-		0.0190	1.0000	3.0000	3.0000	12.1000	877		
18												
19	875	D/S Kolomiya	HYDROMET49-920225-		0.0250	0.9700	3.0000	2.4000	13.8000	875		
20	875	D/S Kolomiya	HYDROMET49-920507-		0.0060	0.8200	2.1500	3.4400	10.7000	875		
21	875	D/S Kolomiya	HYDROMET49-920720-		0.0120	0.2500	2.4000	2.6500	8.1500	875		
22	875	D/S Kolomiya	HYDROMET49-920803-		0.0040	0.8700	1.4500	5.1400	9.1500	875		
23	875	D/S Kolomiya	HYDROMET49-921006-		0.0420	1.1000	1.9500	3.9000	10.2000	875		
24	875	D/S Kolomiya	HYDROMET49-921108-		0.0120	0.8200	3.2500	2.9000	10.8000	875		
25	875	D/S Kolomiya	HYDROMET49-921210-		0.0290	1.0000	2.4500	3.2000	11.8000	875		
26												
27	780	U/S Chernovitsi	HYDROMET50-920130-		0.0150	0.2500	2.8500	2.8000	12.4000	780		
28	780	U/S Chernovitsi	HYDROMET50-920227-		0.0250	0.7700	2.3000	3.4000	13.5000	780		
29	780	U/S Chernovitsi	HYDROMET50-920331-			0.9200	1.9000	3.5000	10.6000	780		
30	780	U/S Chernovitsi	HYDROMET50-920430-		0.0210	0.8200	1.5000	3.1000	10.3000	780		
31	780	U/S Chernovitsi	HYDROMET50-920511-		0.0180	1.1000	1.7500	3.4000	8.8000	780		
32	780	U/S Chernovitsi	HYDROMET50-920630-			2.0200	2.0000	2.4000	8.3000	780		
33	780	U/S Chernovitsi	HYDROMET50-920722-		0.0080	0.7700	0.8000	5.3000	7.9000	780		
34	780	U/S Chernovitsi	HYDROMET50-920807-			0.8200	0.7000	2.5000	7.0000	780		
35	780	U/S Chernovitsi	HYDROMET50-920908-			0.7200	2.2500	5.3000	8.7000	780		
36	780	U/S Chernovitsi	HYDROMET50-920828-			0.7700	1.4000	3.4000	11.9000	780		
37	780	U/S Chernovitsi	HYDROMET50-921018-			0.9200	1.7500	2.6000	9.9000	780		
38	780	U/S Chernovitsi	HYDROMET50-921125-		0.0080	1.5000	1.7500	2.7000	10.3000	780		
39												
40	773	D/S Chernovitsi	HYDROMET51-920130-		0.0380	0.3000	2.6500	5.0000	13.4000	773		
41	773	D/S Chernovitsi	HYDROMET51-920227-		0.0150	0.6700	2.2500	3.8000	13.6000	773		
42	773	D/S Chernovitsi	HYDROMET51-920331-			0.8200	2.1500	3.9000	10.2000	773		
43	773	D/S Chernovitsi	HYDROMET51-920430-		0.0210	0.7200	1.5000	2.0000	9.4000	773		
44	773	D/S Chernovitsi	HYDROMET51-920511-		0.0100	0.8200	1.5000	2.8000	9.5000	773		
45	773	D/S Chernovitsi	HYDROMET51-920630-			1.4500	1.6000	2.2000	8.8000	773		
46	773	D/S Chernovitsi	HYDROMET51-920722-		0.0040	0.8700	0.9500	4.9200	8.8000	773		
47	773	D/S Chernovitsi	HYDROMET51-920807-		0.0080	0.5700	0.7500	3.1000	7.3000	773		
48	773	D/S Chernovitsi	HYDROMET51-920908-			0.6700	2.2000	5.3000	8.8000	773		
49	773	D/S Chernovitsi	HYDROMET51-920828-			0.8200	1.3000	3.5000	12.7000	773		
50	773	D/S Chernovitsi	HYDROMET51-921018-			0.5700	1.8500	2.7000	10.3000	773		
51	773	D/S Chernovitsi	HYDROMET51-921125-		0.0080	0.8200	1.7500	4.4000	13.0000	773		
52												

Table 7

Prut River Water Quality Data, 1992 (continued)

	STATION KM	STA NAME	SAMPLEID	FLOW m3/s	PHOSPHATES	AMMONIA	NITRATES_N	BOD_5	DO_MG_L	STA		
53	799	DD/S Chernovitsi	HYDROMET52-920130-		0.0150	0.3200	2.5500	4.9000	13.9000	799		
54	799	DD/S Chernovitsi	HYDROMET52-920227-		0.0150	0.5700	1.7500	3.4000	13.4000	799		
55	799	DD/S Chernovitsi	HYDROMET52-920331-			0.9200	1.8500	3.2000	10.8000	799		
56	799	DD/S Chernovitsi	HYDROMET52-920430-		0.0160	0.6700	1.3500	2.6000	9.7000	799		
57	799	DD/S Chernovitsi	HYDROMET52-920511-		0.0100	0.9700	1.3500	2.9000	9.8000	799		
58	799	DD/S Chernovitsi	HYDROMET52-920630-			3.2000	2.1000	2.2000	8.7000	799		
59	799	DD/S Chernovitsi	HYDROMET52-920722-		0.0120	0.5700	0.8000	5.1000	8.1000	799		
60	799	DD/S Chernovitsi	HYDROMET52-920807-		0.0040	0.6700	0.7000	3.7000	8.7000	799		
61	799	DD/S Chernovitsi	HYDROMET52-920908-			0.6700	1.5000	6.5000	8.8000	799		
62	799	DD/S Chernovitsi	HYDROMET52-920828-			0.6700	1.6000	4.2000	12.3000	799		
63	799	DD/S Chernovitsi	HYDROMET52-921016-			0.6200	1.7500	2.6000	10.4000	799		
64	799	DD/S Chernovitsi	HYDROMET52-921125-		0.0420	1.3500	1.1000	3.7000	12.0000	799		
65												
66	710	Orofliana	OROFTIANA-920302-DR-RO	72.0		0.6400	3.6000	2.9000	12.8000	710		
67	710	Orofliana	OROFTIANA-920302-ST-MO	46.2	0.0130	0.3800	7.7500	4.7000	11.4000	710		
68	710	Orofliana	OROFTIANA-920402-ST-MO	36.6		2.0000	4.7500	4.3000	10.3000	710		
69	710	Orofliana	OROFTIANA-920504-DR-RO	116.0	0.3600	0.1900	1.4000	2.3000	10.4000	710		
70	710	Orofliana	OROFTIANA-920505-ST-MO	116.0	0.0010	0.4700	0.0000	2.7000	10.3000	710		
71	710	Orofliana	OROFTIANA-920804-MI-RO	46.0	0.1200	0.1900	3.4000	2.7500	9.2800	710		
72	710	Orofliana	OROFTIANA-920808-MI-RO	119.0		0.0400	2.1000	4.0300	9.8000	710		
73	710	Orofliana	OROFTIANA-921103-MI-RO	193.0		0.5100	1.6000	3.2000	12.7000	710		
74	710	Orofliana	OROFTIANA-921202-MI-RO	47.1	0.1200	0.5700	4.3000	3.1900	3.5000	710		
75												
76	658	Radauti	RADAUTI-920205-DR-MOL	34.0		0.8500		1.4800	10.8000	658		
77	658	Radauti	RADAUTI-920205-DR-ROM	34.0		0.6300	10.4000	2.9500	12.1000	658		
78	658	Radauti	RADAUTI-920205-ST-MOL	34.0	0.1800	0.7800	4.3000	1.5000	10.8000	658		
79	658	Radauti	RADAUTI-920505-DR-MOL	107.0	0.0010	0.4800	0.0000	2.7000	10.4000	658		
80	658	Radauti	RADAUTI-920505-DR-ROM	107.0	0.1800	0.1000	8.4000	2.4000	10.4000	658		
81	658	Radauti	RADAUTI-920505-ST-MOL	107.0		0.0000	1.1000	4.0000	8.1000	658		
82	658	Radauti	RADAUTI-920804-MI-ROM	46.0	0.2000	0.3400	3.2000	2.9000	9.4000	658		
83	658	Radauti	RADAUTI-920806-ST-MOL	43.0	0.0400	0.3700	2.3000	1.5000	8.0000	658		
84	658	Radauti	RADAUTI-921103-MI-ROM	193.0		0.4100	1.6000	4.6800	11.2000	658		
85	658	Radauti	RADAUTI-921108-ST-MOL	90.0	0.2400	0.4000	7.9000	3.4800	10.5000	658		
86												
87	536	Stinca	STINCA-920206-MI-MOL	31.6	0.0800	0.5000	3.8000	2.0900	13.2000	536		
88	536	Stinca	STINCA-920206-MI-ROM	31.6		0.1000	4.8000	3.1800	12.3000	536		
89	536	Stinca	STINCA-920506-MI-MOL	131.0	0.0060	0.3600	5.9000	1.9900		536		
90	536	Stinca	STINCA-920506-MI-ROM	131.0	0.3600	0.3900	8.0000	2.3500	11.7000	536		
91	536	Stinca	STINCA-920805-MI-ROM	66.1	0.2900	0.5100	3.3000	3.1000	8.9000	536		
92	536	Stinca	STINCA-920806-MI-MOL	66.1	0.0180	0.1750	1.4800	5.5000		536		
93	536	Stinca	STINCA-921104-MI-ROM	49.6		0.0320	2.0000	2.7800	10.5000	536		
94	536	Stinca	STINCA-921109-MI-MOL	49.6	0.0800	0.1300	8.3000	1.8000	10.7000	536		
95												
96	395	Sculeni	SCULENI-920211-MI-MOL	39.3	0.0300	0.2500	2.9000	4.4000	13.5000	395		
97	395	Sculeni	SCULENI-920211-MI-ROM	39.3		0.7800	8.0000	2.6000	13.9000	395		
98	395	Sculeni	SCULENI-920511-DR-MOL	141.0	0.0300	0.4300	6.9000		11.5000	395		
99	395	Sculeni	SCULENI-920511-DR-ROM	141.0		0.3400	7.0000	3.2000	9.8000	395		
100	395	Sculeni	SCULENI-920511-MI-MOL	141.0	0.0300	0.0300	7.0000	1.8000	10.9000	395		
101	395	Sculeni	SCULENI-920511-MI-ROM	141.0		0.2600	7.5000	3.4000	10.1000	395		
102	395	Sculeni	SCULENI-920511-ST-MOL	141.0	0.0400	0.4000	6.7500	1.8000	10.9000	395		
103	395	Sculeni	SCULENI-920511-ST-ROM	141.0		0.2800	7.5000	3.4000	9.9000	395		
104	395	Sculeni	SCULENI-920610-DR-MOL	44.0	0.1000	0.4800	7.5000	3.0000	8.1000	395		

Table 7

Prut River Water Quality Data, 1992 (continued)

	STATION KM	STA NAME	SAMPLEID	FLOW m3/s	PHOSPHATES	AMMONIA	NITRATES_N	BOD_5	DO_MG_L	STA		
105	395	Sculeni	SCULENI-920810-DR-ROM	44.0		0.2000	5.5000	1.7000	7.0000	395		
106	395	Sculeni	[illegible]NI-920810-MI-MOL	44.0	0.1000	0.6400	7.2000	3.4000	6.9000	395		
107	395	Sculeni	[illegible]ULENI-920810-MI-ROM	44.0		0.2000	5.3000	2.7000	7.1000	395		
108	395	Sculeni	SCULENI-920810-ST-MOL	44.0	0.1000	0.4600	7.3000	2.8000	8.4000	395		
109	395	Sculeni	SCULENI-920810-ST-ROM	44.0	0.2000	0.4500	5.0000	2.3000	7.3000	395		
110	395	Sculeni	SCULENI-921109-DR-MOL	46.8		0.0025	3.2300	2.1010	12.3000	395		
111	395	Sculeni	SCULENI-921109-DR-ROM	46.8	0.2700	0.3100	5.1000	3.6000	12.1000	395		
112	395	Sculeni	SCULENI-921109-MI-MOL	46.8		0.0035	3.2200	2.5000	12.9000	395		
113	395	Sculeni	SCULENI-921109-MI-ROM	46.8	0.2700	0.2800	5.0000	3.5000	12.1000	395		
114	395	Sculeni	SCULENI-921109-ST-MOL	46.8		0.0250	3.2200	2.0000	12.7000	395		
115	395	Sculeni	SCULENI-921109-ST-ROM	46.8	0.2700	0.3100	5.0000	3.1000	12.3000	395		
116												
117	376	Ungheni	UNGHENI-920108-MI-MOL	45.2		0.3000	3.1000	1.8000	15.4000	376		
118	376	Ungheni	UNGHENI-920108-MI-ROM	45.2	0.0580	0.1280	9.5000	4.9000	13.7000	376		
119	376	Ungheni	UNGHENI-920211-MI-MOL	38.3	0.0300	0.2000	3.9000	2.6000	12.9000	376		
120	376	Ungheni	UNGHENI-920211-MI-ROM	38.3		0.2800	9.5000	2.4000	13.2000	376		
121	376	Ungheni	UNGHENI-920310-MI-MOL	37.0		0.3000	2.7000	3.9000	13.9000	376		
122	376	Ungheni	UNGHENI-920310-MI-ROM	37.0		0.5000	7.3000	4.8000	12.7000	376		
123	376	Ungheni	UNGHENI-920414-MI-ROM	59.6		0.1179	9.7000	2.7000	11.1000	376		
124	376	Ungheni	UNGHENI-920512-MI-ROM	141.0		0.3000	8.0000	3.0000	9.8000	376		
125	376	Ungheni	UNGHENI-920609-MI-MOL	72.9	0.1100	0.4100	9.1100	1.2900	10.9000	376		
126	376	Ungheni	UNGHENI-920609-MI-ROM	72.9		0.1300	6.0000	3.1000	9.1000	376		
127	376	Ungheni	UNGHENI-920714-MI-MOL	134.0	0.0730	0.7200	2.9500	1.6700	8.9000	376		
128	376	Ungheni	UNGHENI-920714-MI-ROM	134.0		0.4350	9.2000	4.0000	8.2000	376		
129	376	Ungheni	UNGHENI-920811-MI-MOL	66.0	0.1900	0.3500	8.0500	1.6600	9.1200	376		
130	376	Ungheni	UNGHENI-920811-MI-ROM	66.6		0.2000	5.3000	2.9000	7.9000	376		
131	376	Ungheni	UNGHENI-920915-MI-MOL	44.5	0.1620	0.7800	6.4200	2.4000	15.5000	376		
132	376	Ungheni	UNGHENI-920915-MI-ROM	44.5		0.5800	5.0000	2.2000	9.8000	376		
133	376	Ungheni	UNGHENI-921013-MI-MOL	44.5	0.1350	0.2800	5.9400	1.5800	12.1000	376		
134	376	Ungheni	UNGHENI-921013-MI-ROM	44.5		0.1790	6.5000	2.7000	10.1000	376		
135	376	Ungheni	UNGHENI-921110-MI-MOL	47.9	0.2280	0.2500	9.1000	5.5800	15.0000	376		
136	376	Ungheni	UNGHENI-921110-MI-ROM	47.9	0.3100	0.3800	5.0000	3.5000	11.7000	376		
137	376	Ungheni	UNGHENI-921205-MI-ROM	50.8		0.5800	6.5000	3.4000	10.2000	376		
138	376	Ungheni	UNGHENI-921208-MI-MOL	50.8	0.2510	0.1900	9.1500	1.2000	0.0000	376		
139												
140	353	Prisecani	PRISECANI-920108-DR-ROM	52.2	0.2330	4.0300	8.0000	9.7000	10.4000	353		
141	353	Prisecani	PRISECANI-920108-ST-MOL	52.2		2.1500	6.0000	9.2000	12.6000	353		
142	353	Prisecani	PRISECANI-920211-DR-ROM	49.7	0.4340	6.2200	5.5000	11.7000	12.0000	353		
143	353	Prisecani	PRISECANI-920211-ST-MOL	49.7	0.1900	1.9000	5.2000	7.3000	12.8000	353		
144	353	Prisecani	PRISECANI-920211-ST-ROM	49.7	0.6030	4.4600	6.5000	11.0000	12.3000	353		
145	353	Prisecani	PRISECANI-920311-DR-ROM	50.7	0.2700	4.1600	2.7000	7.2000	9.8000	353		
146	353	Prisecani	PRISECANI-920311-ST-MOL	50.7		2.4500	3.0000	13.3000	7.9000	353		
147	353	Prisecani	PRISECANI-920414-DR-ROM	80.6	0.5890	2.6900	3.0000	6.6000	7.4000	353		
148	353	Prisecani	PRISECANI-920512-DR-ROM	146.0	0.3800	3.3200	4.7000	8.2000	8.5000	353		
149	353	Prisecani	PRISECANI-920609-DR-ROM	77.7	0.4700	2.5600	4.5000	6.2000	7.9000	353		
150	353	Prisecani	PRISECANI-920609-ST-MOL	77.7	0.1770	1.1300	12.8000	2.2500	9.4000	353		
151	353	Prisecani	PRISECANI-920714-DR-ROM	131.0	0.2700	2.8000	7.8000	6.2000	7.2000	353		
152	353	Prisecani	PRISECANI-920714-ST-MOL	131.0	0.0180	0.7000	3.0800	2.9700	8.4700	353		
153	353	Prisecani	PRISECANI-920811-DR-ROM	71.3	0.6500	0.9200	4.2000	5.0000	6.8000	353		
154	353	Prisecani	PRISECANI-920811-ST-MOL	71.3	0.4000	0.3500	8.0500	2.6500	7.0000	353		
155	353	Prisecani	PRISECANI-920915-DR-ROM	55.6	0.9700	3.7000	4.0000	5.2000	7.4000	353		
156	353	Prisecani	PRISECANI-920915-ST-MOL	55.6	0.2750	1.7900	5.2800	4.4000	13.8000	353		

Table 7

Prut River Water Quality Data, 1992 (continued)

	STATION KM	STA NAME	SAMPLEID	FLOW m3/s	PHOSPHATES	AMMONIA	NITRATES_N	BOD_5	DO_MG_L	STA		
157	353	Prisecani	PRISECANI-921013-DR-ROM	55.1	0.1000	3.5800	4.0000	6.9000	7.6000	353		
158	353	Prisecani	PRISECANI-921110-DR-ROM	56.5	0.6510	2.4500	4.5000	6.7000	9.6000	353		
159	353	Prisecani	PRISECANI-921110-ST-MOL	56.5	0.3300	0.5400	9.3000	9.7700	13.7000	353		
160	353	Prisecani	PRISECANI-921208-ST-MOL	55.6	0.4040	1.8700	9.0800	3.1400	3.5000	353		
161	353	Prisecani	PRISECANI-921215-DR-ROM	55.8	0.6500	2.9500	3.5000	5.9000	8.2000	353		
162												
163	292	Albita	ALBITA-920213-DR-ROM	48.0	0.2200	2.4000	5.5000		10.0000	292		
164	292	Albita	ALBITA-920213-MI-ROM	48.0	0.2200	2.4000	5.4000		10.2000	292		
165	292	Albita	ALBITA-920213-ST-ROM	48.0	0.2500	2.4000	8.5000		10.2000	292		
166	292	Albita	ALBITA-920514-MI-MOL	136.0	0.0920	0.6000	10.6000	2.3000	8.1400	292		
167	292	Albita	ALBITA-920611-DR-ROM	70.9	0.2200	0.9700	5.1000		7.5000	292		
168	292	Albita	ALBITA-920611-MI-MOL	70.9	0.2510	0.6400	11.9000	2.9700	9.8000	292		
169	292	Albita	ALBITA-920611-MI-ROM	70.9	0.1900	0.9500	5.1000		7.4000	292		
170	292	Albita	ALBITA-921110-DR-ROM	50.9	0.2550	1.6900	4.7000		10.8000	292		
171	292	Albita	ALBITA-921110-MI-MOL	50.9	0.3300	1.2500	10.4000	6.2000	13.2000	292		
172	292	Albita	ALBITA-921110-MI-ROM	50.9	0.2250	1.8600	4.5000		10.7000	292		
173												
174	152	Falciu	FALCIU-920217-DR-ROM	58.5	0.3300	2.1000	7.4000		10.2000	152		
175	152	Falciu	FALCIU-920217-MI-ROM	56.5	0.2600	2.2000	4.6000		10.8000	152		
176	152	Falciu	FALCIU-920518-DR-MOL	87.2			12.7000		7.9000	152		
177	152	Falciu	FALCIU-920518-DR-ROM	87.2	0.1500	1.2200	6.3000		9.0000	152		
178	152	Falciu	FALCIU-920518-MI-MOL	87.2			12.7000		6.7000	152		
179	152	Falciu	FALCIU-920518-MI-ROM	87.2	0.1600	1.2600	6.3000		9.1000	152		
180	152	Falciu	FALCIU-920518-ST-MOL	87.2			17.7000		6.7000	152		
181	152	Falciu	FALCIU-920518-ST-ROM	87.2	0.2000	1.2600	8.9000		9.0000	152		
182	152	Falciu	FALCIU-920617-MI-MOL	45.0			15.2000		8.0000	152		
183	152	Falciu	FALCIU-920617-ST-MOL	45.0			2.8000		8.2000	152		
184	152	Falciu	FALCIU-921116-DR-MOL	55.4		0.1900		5.4000	11.2000	152		
185	152	Falciu	FALCIU-921116-DR-ROM	55.4	0.1900	1.0100	4.9000		10.4000	152		
186	152	Falciu	FALCIU-921116-MI-MOL	55.4		0.9300		6.8000	10.9000	152		
187	152	Falciu	FALCIU-921116-MI-ROM	55.4	0.1550	0.8600	4.7000		10.3000	152		
188	152	Falciu	FALCIU-921116-ST-MOL	55.4		1.0100		6.8000	11.1000	152		
189												
190	78	Oancea	OANCEA-920218-DR-ROM	50.3	0.0350	0.7200	1.7010		9.6800	78		
191	78	Oancea	OANCEA-920218-MI-ROM	50.3	0.0490	0.7000	1.5770		9.9800	78		
192	78	Oancea	OANCEA-920518-DR-ROM	88.4	0.0040	0.3400	2.1800		7.6000	78		
193	78	Oancea	OANCEA-920518-MI-ROM	88.4	0.0050	0.3800	1.9900		7.9000	78		
194	78	Oancea	OANCEA-920518-ST-MOL	88.4		0.1800			6.3000	78		
195	78	Oancea	OANCEA-920518-ST-ROM	88.4	0.0190	0.2700	1.9100		7.6000	78		
196	78	Oancea	OANCEA-920618-DR-MOL	40.6					6.2000	78		
197	78	Oancea	OANCEA-920618-DR-ROM	40.6	0.0130	0.2980	0.5650		4.0500	78		
198	78	Oancea	OANCEA-920618-MI-MOL	40.6		0.0000			8.1000	78		
199	78	Oancea	OANCEA-920618-MI-ROM	40.6	0.0060	0.4460	0.5870		4.5500	78		
200	78	Oancea	OANCEA-920618-ST-MOL	40.6					8.1000	78		
201	78	Oancea	OANCEA-920618-ST-ROM	40.6	0.0970	0.5580	0.6550		4.1200	78		
202	78	Oancea	OANCEA-921117-DR-MOL	50.3		0.6200			11.4000	78		
203	78	Oancea	OANCEA-921117-DR-ROM	50.3		0.3400	1.1700		11.8000	78		
204	78	Oancea	OANCEA-921117-MI-MOL	50.3		1.1700			11.6000	78		
205	78	Oancea	OANCEA-921117-MI-ROM	50.3		0.3900	1.0100		11.2000	78		
206	78	Oancea	OANCEA-921117-ST-MOL	50.3		0.4800			11.5000	78		
207	78	Oancea	OANCEA-921117-ST-ROM	50.3		0.3100	1.2100		11.7000	78		
208												

Table 7

Prut River Water Quality Data, 1992 (continued)

	STATION KM	STA NAME	SAMPLEID	FLOW m3/s	PHOSPHATES	AMMONIA	NITRATES_N	BOD_5	DO_MG_L	STA		
208	1	Galati	GALATI-920220-DR-ROM	46.7	0.0560	1.2800	1.7380		9.9100	1		
210	1	Galati	GALATI-920220-MI-ROM	46.7	0.0480	1.2600	1.7700		10.4000	1		
211	1	Galati	GALATI-920317-DR-ROM	42.1	0.0870	0.4680	6.3700	4.5000	10.2000	1		
212	1	Galati	GALATI-920317-MI-ROM	42.1	0.0950	0.3610	6.5700	4.1500	10.3800	1		
213	1	Galati	GALATI-920317-ST-ROM	42.1	0.0950	0.3020	6.8500	3.9300	10.4200	1		
214	1	Galati	GALATI-920421-DR-MOL	76.4	0.0000	1.2000			0.0000	1		
215	1	Galati	GALATI-920421-DR-ROM	76.4	0.0200	0.3800	1.3030		9.3000	1		
216	1	Galati	GALATI-920421-MI-MOL	76.4	0.0000	0.4000			0.0000	1		
217	1	Galati	GALATI-920421-MI-ROM	76.4	0.0230	0.3400	0.5980		9.2000	1		
218	1	Galati	GALATI-920421-ST-MOL	76.4	0.0000	0.8000			0.0000	1		
219	1	Galati	GALATI-920421-ST-ROM	76.4	0.0110	0.0800	1.2190		9.2000	1		
220	1	Galati	GALATI-920521-DR-ROM	82.2	0.0410	0.3000	1.3100		7.3000	1		
221	1	Galati	GALATI-920521-MI-ROM	82.2	0.0750	0.2900	1.4200		7.4000	1		
222	1	Galati	GALATI-920521-ST-ROM	82.2	0.0970	0.7400	1.1900		7.4000	1		
223	1	Galati	GALATI-920616-DR-ROM	77.0	0.0460	0.4200	1.5500		4.0000	1		
224	1	Galati	GALATI-920616-MI-MOL	77.0	0.0000	0.1700			0.0000	1		
225	1	Galati	GALATI-920616-MI-ROM	77.0	0.0850	0.3900	1.6300		4.2000	1		
226	1	Galati	GALATI-920616-ST-MOL	77.0		0.2500			0.0000	1		
227	1	Galati	GALATI-920616-ST-ROM	77.0	0.0700	0.3800	1.5800		4.2000	1		
228	1	Galati	GALATI-920717-DR-MOL	93.0					9.2000	1		
229	1	Galati	GALATI-920717-DR-ROM	93.0	0.0220	0.1400	0.8580		6.4000	1		
230	1	Galati	GALATI-920717-MI-MOL	93.0					11.0000	1		
231	1	Galati	GALATI-920717-MI-ROM	93.0	0.0190	0.1900	0.8550		6.2000	1		
232	1	Galati	GALATI-920717-ST-MOL	93.0					9.7000	1		
233	1	Galati	GALATI-920717-ST-ROM	93.0	0.0230	0.1700	0.7230		6.4000	1		
234	1	Galati	GALATI-920818-DR-MOL	40.6			0.2500		8.3000	1		
235	1	Galati	GALATI-920818-DR-ROM	40.6	0.0130	0.3000	0.5850		4.1000	1		
236	1	Galati	GALATI-920818-MI-MOL	40.6			1.5000		8.2000	1		
237	1	Galati	GALATI-920818-MI-ROM	40.6	0.0080	0.4500	0.5840		4.5000	1		
238	1	Galati	GALATI-920818-ST-MOL	40.6			3.7500		8.0000	1		
239	1	Galati	GALATI-920818-ST-ROM	40.6	0.0090	0.5800	0.8550		4.1000	1		
240	1	Galati	GALATI-920822-DR-ROM	45.5	0.0340	0.3800	0.9100		8.4000	1		
241	1	Galati	GALATI-920822-MI-ROM	45.5	0.0270	0.3900	0.9900		7.2000	1		
242	1	Galati	GALATI-920822-ST-ROM	45.5	0.0280	0.3800	0.9600		8.4000	1		
243	1	Galati	GALATI-920824-ST-MOL	45.5		0.2000	1.2500		6.4000	1		
244	1	Galati	GALATI-921020-DR-MOL	50.6		0.2000			8.9000	1		
245	1	Galati	GALATI-921020-DR-ROM	50.6		0.3340	0.8670		8.2000	1		
246	1	Galati	GALATI-921020-MI-MOL	50.6		0.2000			8.5000	1		
247	1	Galati	GALATI-921020-MI-ROM	50.6		0.2820	0.9170		8.4000	1		
248	1	Galati	GALATI-921020-ST-MOL	50.6		0.2000			8.9000	1		
249	1	Galati	GALATI-921020-ST-ROM	50.6		0.1920	1.6700		8.3000	1		
250	1	Galati	GALATI-921119-DR-ROM	49.2	0.0170	0.4980	0.8690		10.8500	1		
251	1	Galati	GALATI-921119-MI-ROM	49.2	0.0140	0.4480	0.9980		10.7900	1		
252	1	Galati	GALATI-921119-ST-ROM	49.2	0.0169	0.4920	1.0100		11.8000	1		
253	1	Galati	GALATI-921215-DR-ROM	45.5	0.0800	0.6300	0.7900		11.2000	1		
254	1	Galati	GALATI-921215-MI-ROM	45.5	0.0850	0.6400	0.7090		11.4000	1		
255	1	Galati	GALATI-921215-ST-ROM	45.5	0.0820	0.6300	0.6770		11.6000	1		
256												
257												
258												
259												
260												

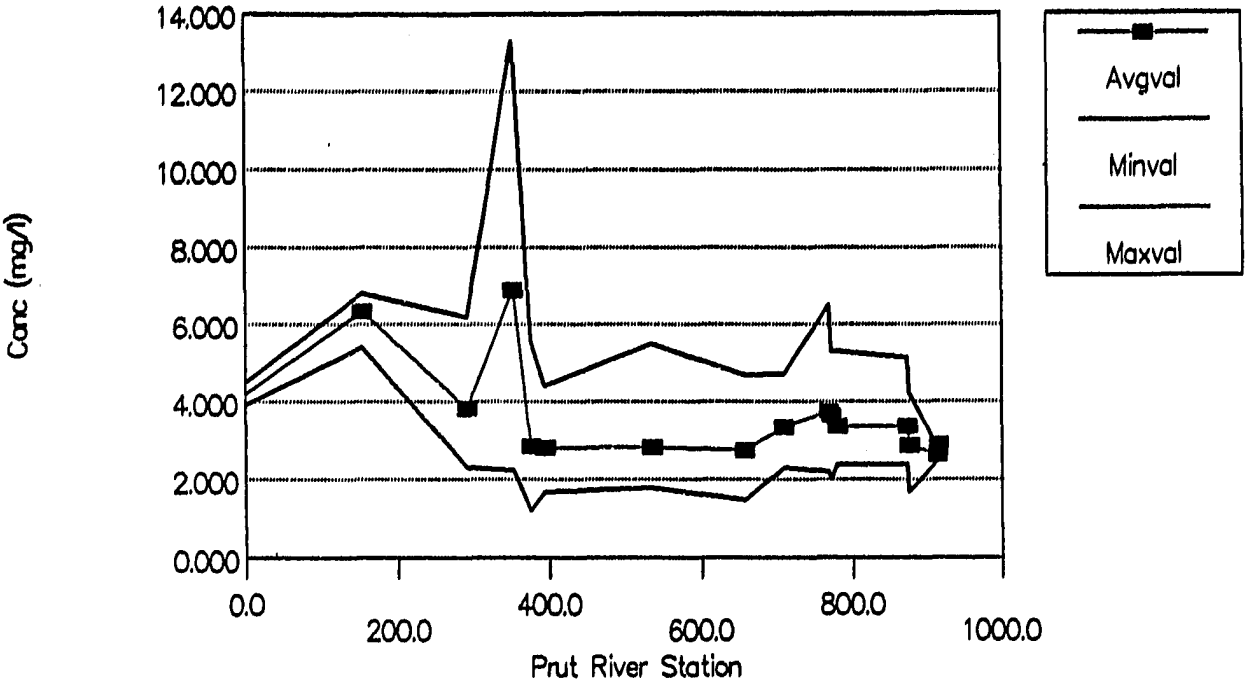


Figure 3

DEMDESS Water Quality Profile—BOD-5, 1992

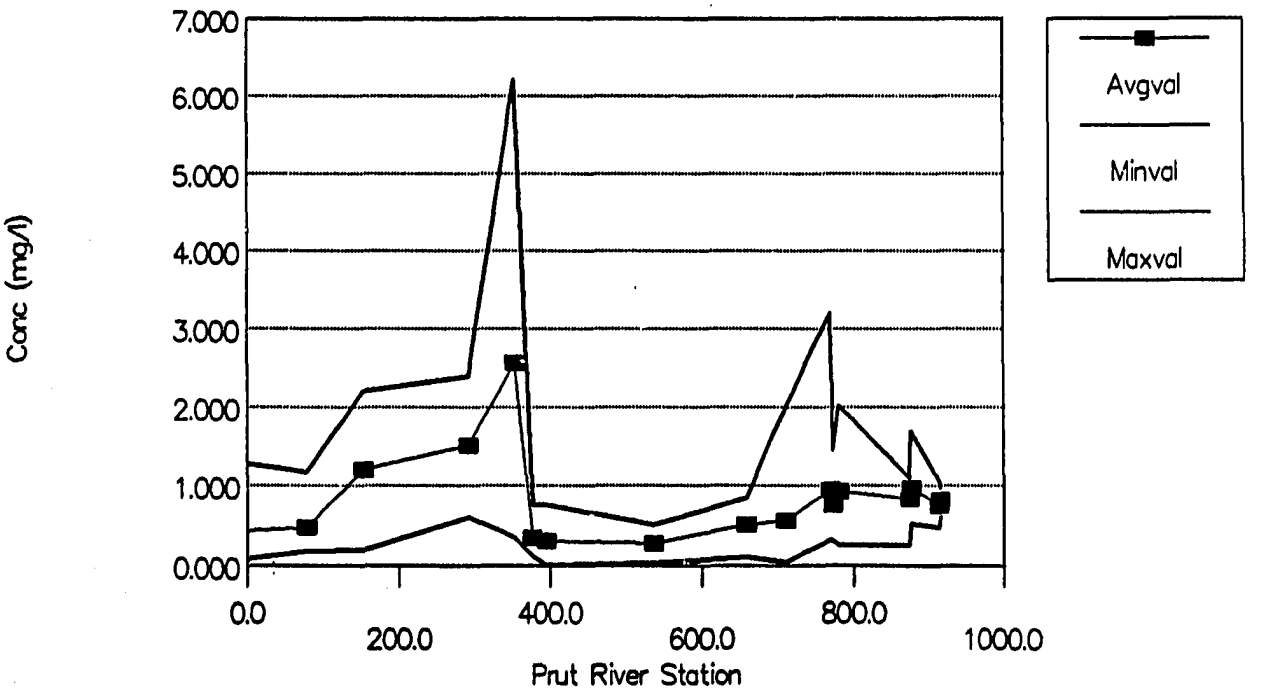


Figure 4

DEMDESS Water Quality Profile—Ammonia, 1992

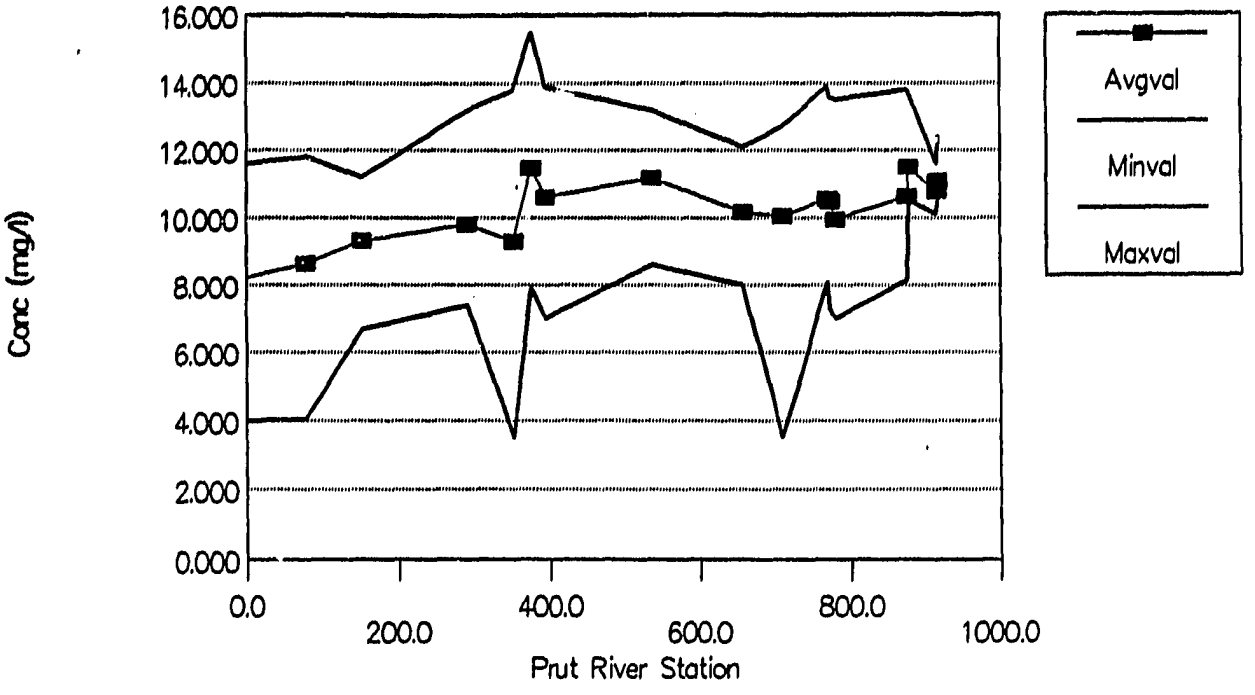


Figure 5

DEMDESS Water Quality Profile—Dissolved Oxygen, 1992

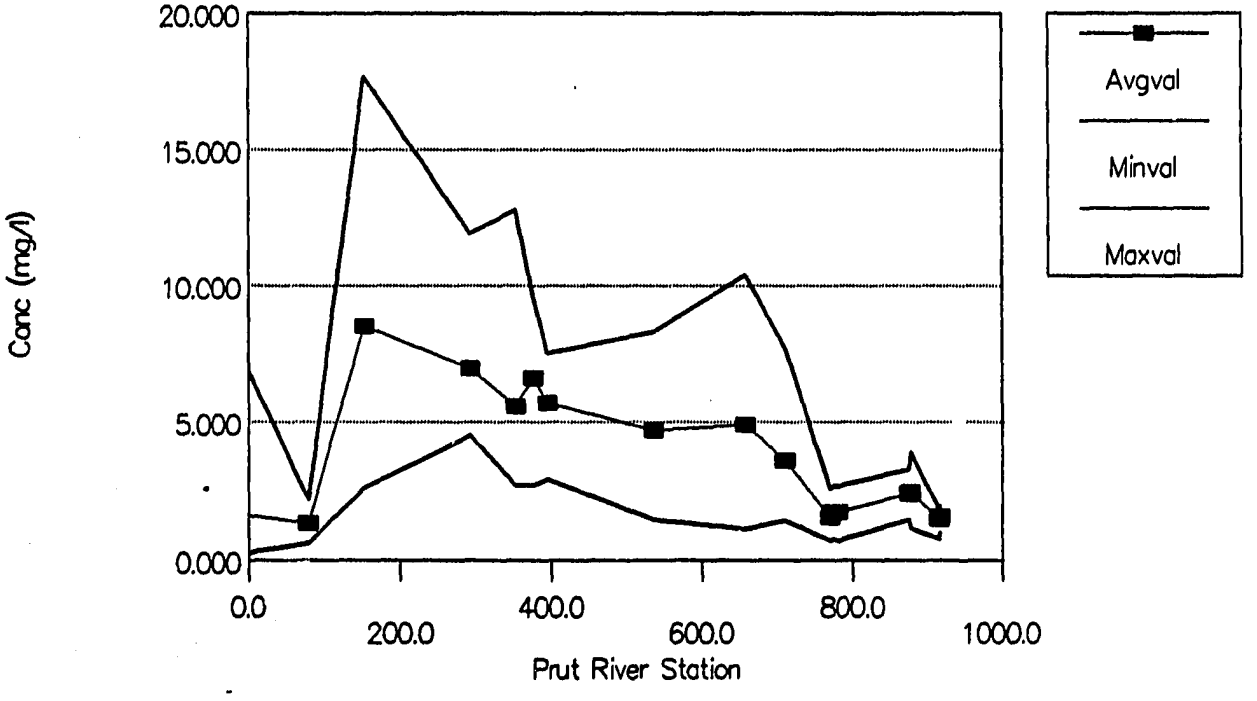


Figure 6

DEMDESS Water Quality Profile—Nitrates, 1992

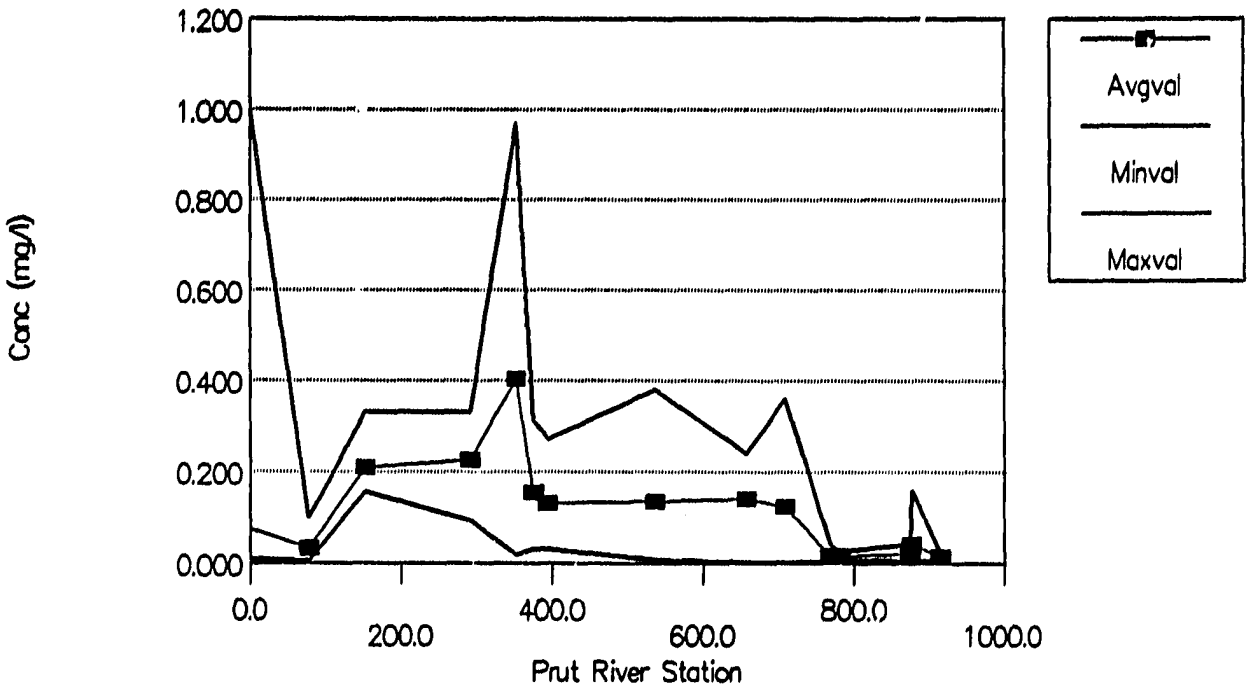


Figure 7

DEMDESS Water Quality Profile—Phosphates, 1992

The most significant known pollution problems are discharges of heavy metals from the Chernivtsy area and high organic loadings from the Iasi area. The impact of pesticides from Moldova may also be a significant problem. A review of available data on pesticide levels in Prut waters found no measurable DDT in the few samples tested in Ukraine. Some pesticides were measured in soil in Romania, but no data were available on such measurements in the river.

A recent technical paper by Chairman Ion Dediu of Moldova's State Department of Environmental Protection and Natural Resources (DEP) provided information on toxic substances in the Prut. This paper summarized pesticide levels in the Prut River at Leova and Cislita, and in the Danube at Giurgiulesti. These levels are summarized in Table 6. Comparison of the pesticide levels with the water quality criteria indicates that they are below U.S. regulatory maximum contaminant levels except for DDT, which is recommended to be zero or near zero to minimize carcinogenic risks. Table 6 also summarizes pesticide measurements in a few locations in the Prut River from 1977 through 1987.

Table 8 indicates water quality criteria for various uses, and Table 9 lists the drinking water standards in Moldova. Moldova uses the 1973 Soviet standards, as modified in 1982.

Table 8

Water Quality Criteria for Various Uses

Parameter	Drinking Water (DW)	DW Source Requiring Min. Treat.	DW Source Requiring Adv. Treat.	Irrigation Water, No Use Restriction/ (Severe Restriction)	Livestock Watering
Conventional Parameters					
Total Coliforms, MPN/100 ml	0 - 10	50	5,000		
Dissolved Oxygen, mg/l		> 6.5 - 7.5	> 4 - 5		
BOD, mg/l		< 1 - 3	< 3 -9		
Nitrate-N, mg/l	10			< 5 (> 30)	100
Total Dissolved Solids, mg/l	1,000			450 (> 2,000)	1,000 - 10,000
Pesticides					
DDT, ug/l	1 (See note 3 below)				
Lindane, ug/l	3 (MCLG=0.2, MCL=0.2)				
Atrazine, ug/l	MCLG=3, MCL=3				
Simazine, ug/l	MCLG=4, MCL=4				

NOTES:

1. Above criteria are taken from the publication, "Management and Control of the Environment, World Health Organization, 1989", except MCLG and MCL criteria are from the USEPA drinking water regulations. Above parameters are not comprehensive and they have been listed because some related Prut Basin data are available.

2. MCLG: Maximum Contaminant Level Goal (non-enforceable), MCL: Maximum Contaminant Level (enforceable).

3. Per EPA Water Quality Criteria, DDT level should be zero based on the non-threshold assumption for this chemical. At cancer risk levels of 10^{-5}, 10^{-6} and 10^{-7}, the corresponding criteria are 0.24 ng/l, 0.024 ng/l and 0.0024 ng/l.

Table 9

Drinking Water Standards in Moldova

Constituency	1973, mg/l	1982, mg/l
Aluminum (Al^3)	0.5	Same
Arsenic (As^3, As^5+)	0.05	Same
Berylium (Be^2+	0.0002	Same as 1973
Chlorides	350	Same
Copper (Cu)	1.0	Same
Fluorides I & II	1.5	Same
Fluorides III	1.2[b]	Same
Fluorides IV	0.7	Same
Hardness		7.0
Iron (Fe^3)	0.3	Same
Lead	0.1	0.03
Manganese (Mn^2)	0.1	Same
Molybdimum (Mo^2+)	0.5	0.25
Nitrates[a]	10	45
Polyphosphates		3.5
Selenium (Se)	0.001	Same
Strontium (Sr)	2.0	7.0
Sulfates	500	Same
Total Dissolved Solids		1,000
Zinc (Zn)	5.0	Same

[a] Not clearly indicated, but the units are believed to be as "N" for 1973 and as "NO_3." in the 1982 standards.

[b] Moldova uses this level as its standard.

2.9.2 Tributaries of the Prut

In the Ukraine, the Prut's major tributary is the Cheremosh River. Annual statistical data indicate no water quality problems for this tributary.

The Romanian drainage area of the Prut has some important tributaries. One of the most stressed is the Bahlui, which receives domestic, industrial, and Tomesti pig farm wastewaters from Iasi. The relatively short reach of the Bahlui from Iasi to the point at which it discharges into the Jijia is considered an open sewer. Downstream from the confluence of the Bahlui, the Jijia has significant water quality problems. Most of the other Romanian tributaries to the Prut also have significant loads.

Water quality data for tributaries on the Moldovan side of the Prut point to pollution from agricultural activities, as claimed by the authorities. In certain cases, available data indicate elevated levels of nutrients and TDS levels above 1,000 mg/l.

2.10 Drinking Water Sources and Public Health Issues

2.10.1 Ukraine

Drinking Water

In Ukraine, the Ministry of Community Services is responsible for the design and construction of piped water and wastewater systems. Although operation takes place at the local level, operators are believed to remain under the control of the ministry.

Drinking water comes from bank-filtered waters of the Prut, treated water from the Dneister, and wells. Above Chernivtsy, the Prut, and to a lesser extent the Dneister, are relatively unpolluted, so raw water quality problems are less serious than at downstream locations.

Samples of drinking water are tested twice daily, and the local office of the Ministry of Health (MOH) has stated that "no problems exist" except for odors from chlorination of phenols at certain times in early spring. The local office also asserted that the water is bacteriologically safe.

Following the Chernobyl nuclear accident, water and food were monitored for radioactivity and, after early problems, are now within acceptable limits. Officials admitted to occasional industrial waste spills in the Dneister basin but none in the Prut. They say they monitor pesticides in drinking and surface waters, but no results were available. One official concluded his comments on drinking water quality with the remark that there are "no nitrate problems."

Using the 1992 Annual Health Report as a source, Mr. Marievsky, Head of the MOH's Sanitary Inspection Department in Kiev, quoted the following results of drinking water testing during 1992 in the two Ukrainian oblasts:

- Chernivtsy Oblast:
  - Of 2,245 tests for chemical constituents, 228 (10 percent) failed to meet water quality standards.
  - Of 2,127 bacteriological tests, 116 (5.5 percent) failed to meet water quality standards.
- Ivano-Frankovsk Oblast
  - Of 2,335 chemical tests, 106 (4.5 percent) failed.
  - Of 2,703 bacteriological tests, 122 (4.5 percent) failed.

Public Health

A small amount of public health information was gained from interviews with senior officials at the Chernivtsy Oblast MOH office and the MOH Sanitary Inspection office in Kiev. MOH is responsible for sampling potable water supplies throughout Ukraine and for gathering and maintaining information about public health. Generally, these tasks rest with the regional or oblast offices of MOH.

In general, heart and thyroid conditions are considered the major diseases in the oblast, and some feel this may be related to the Chernobyl accident. At this office and many other locations, people referred to a mysterious problem in which large numbers (no figures were ever offered) of people, mostly children, lost their hair in 1988. Although international medical teams studied the phenomena, no causes were ever determined. As the problem affected people using a variety of water sources (Prut, Dneister, wells), water-borne agents were ruled out.

Mr. Marievsky of MOH/Kiev said the ministry had little information on the health of people living in the Prut basin because it does not collect data classified by river basin. MOH could, however, provide health data for the two Ukrainian oblasts in which the Prut basin lies. Mr. Marievsky cautioned that because of the wide range of factors affecting public health, considerable care must be taken before ascribing particular diseases to poor quality drinking water.

Official sources of health information in the Ukrainian Prut River basin indicated no health problems related to water quality; this topic was not raised by anyone within the environmental agencies in Ukraine.

On the other hand, the USAID Health Profile for Ukraine, prepared in April 1992, states that:

> The health of Ukraine's population is affected by environmental hazards. The extensive use of pesticides, inappropriate technologies in chemical and mining

industries, the repercussions of the Chernobyl accident, and the near absence of water treatment systems have all impacted negatively on the Ukrainian people.[7]

2.10.2 Romania

Since Romania had been studied under previous projects, it was a late addition to the WASH scope of work. Accordingly, attention on the Romanian side of the Prut River basin was focused on pollution issues. The material that follows came primarily from officials of the Iasi regional office of the Agency for Protection of the Environment (APE).

Drinking Water

In Romania, piped water supply (and piped wastewater collection and disposal) is the responsibility of regional water and wastewater companies. These companies are called RAJACs, an acronym for *regia* (one of two types of state organization), *autonomous*, judet (the Romanian equivalent of a county), *aqua* (water), and *canalization* (sewerage). Because there are so many RAJACs, they are named specifically by their location; for example, RAJAC/Iasi, and so forth. These municipal companies that obtain their raw water from sources managed by Apele Romane (AR) supply both drinking water to the people and process water to industries. RAJACs treat the effluent of all industries in its service area. Industries are supposed to provide pretreatment, but RAJACs have no control over the adequacy of such treatment.

Iasi obtains most of its water from the Stinca Reservoir, which is formed behind a dam on the Prut River, and from groundwater sources at Bazin. Other cities and towns in the Prut basin obtain their piped water supply from tributaries of the Prut. In these tributaries, water quality is generally considered acceptable upstream from Iasi and unacceptable downstream. Within Iasi Judet, the only region for which data were obtained, there are 82 villages. Only 10 percent of these have piped water systems, while the rest depend on shallow hand-dug wells for their water supply.

Water provided by piped water systems in Iasi and upstream was said to be fairly good, while the poor quality of water from piped systems downstream from Iasi was said to be a serious problem. Water from the shallow wells appears to be often high in nitrates and ammonium compounds. No details on potable water quality were obtained, but a World Bank paper provided some information on a countrywide basis, stating that "elevated nitrate levels are found in local water supplies in all but 2 of the 41 districts of the country."[8] The Bank paper added that "in 14 districts, more than half of the water supplies exceed the standard of 45

---

[7] *Ukraine: Crisis and Transition: Meeting Human Needs*, UNICEF/WHO Collaborative Mission (with others), February 1992.

[8] Report No. 10613-RO, Romania—*Environment Strategy Paper*, July 31, 1992, World Bank.

45 mg/l," and further stated that "carcinogenic substances exceeding the Romanian standards have been measured in water samples from 32 of the 41 districts of the country."

Public Health

MOH is responsible for sampling potable water supplies throughout Romania, and for gathering and maintaining information about public health, functions generally delegated to the MOH's regional or judet offices.

Liver and other diseases are said to be high among those drinking water from the shallow wells. A study completed in the latter part of 1992 by the Institute for Public Health and Hygiene indicated that morbidity and mortality rates are higher in the Iasi area than any other part of Romania. See Table 10 below for infant mortality rates in 1991.

Table 10

Infant Mortality Rate in the Prut Basin, 1991

Judet (County)	Live birth ratio per 1,000 inhabitants		Still births per 1,000 total births		Death under 1 year per 1,000 live births	
	Urban	Rural	Urban	Rural	Urban	Rural
Botosani	15.3	13.7	8.3	8.3	26.7	35.8
Iasi	10.6	17.6	6.5	3.3	19.7	28.9
Vaslui	12.3	16.4	10.2	7.1	22.8	25.5
Galati	9.5	15.1	5.8	4.0	17.9	28.4
National Average	**11.0**	**12.9**	**7.1**	**6.6**	**19.6**	**25.8**

Source: Official data from 1991 public health statistics.

2.10.3 Moldova

Drinking Water

The Ministry of Community Services is responsible for the construction and operation of Moldova's piped water and wastewater systems. In an interview on April 28, 1993, Minister St. Severovan said there are piped water systems in only 20 cities and 27 towns in the entire country. The ministry is not responsible for household or farm wells, which serve most of the

population's drinking water needs. Countrywide, there are said to be 132,000 shallow wells scattered among 1,530 villages, or an average of 86 wells per village.

Only four cities in the Moldovan side of the Prut basin (Ungheni, Cahul, Leova, and Cantemir—accounting for about one-fourth of the estimated 400,000 people living in the basin) obtain their water from piped systems that extract and treat water from the Prut. In the eight towns without water systems and the estimated 220 Prut basin villages, most people obtain their water from the ubiquitous shallow (10 m deep) hand-dug wells. Assuming a uniform average of 86 wells per village throughout the country, there could be as many as 20,000 shallow wells among these villages and towns.

According to Moldovan drinking water standards, the maximum allowable nitrate concentration is 45 mg/l. (See Table 9.) An MOH letter report dated December 24, 1992, gave the following information on well-water nitrates in the Prut River basin:

Year	Percent Above 45 mg/l
1985	21 percent
1986	31 percent
1987	40 percent
1988	50 percent
1990	49 percent

During an interview, Mr. Sireteanu of MOH said that "groundwater quality" was considered the most serious public health problem in the basin. In fact, the government believes groundwater quality to be poor enough to warrant the construction and extension of piped water systems using treated water from the Prut River. His statement was verified by Minister St. Severovan, who added that the high cost of such a program made its implementation unlikely in the foreseeable future.

In an interview on April 28, 1993, Yuri Ilyinsky, head geologist of the State Association of Production and Investigation of Geology and Topographic and Geodesic Surveys (AGeoM) indicated that the country has three aquifers. The shallowest, related to alluvial soils adjacent to the rivers, serves as the source of all shallow hand-dug wells. Mr. Ilyinsky said that AGeoM considers this aquifer to be of no value as a potable water source because it is relatively high in TDS, occasionally high in nitrates, and high in iron (sometimes in manganese, as well). When asked about pesticides in this aquifer, he said, "We have some, but they're not above the standards."

Groundwater in the Moldovan section of the basin also may have been affected adversely by past overuse of pesticides, herbicides, and fertilizers, but MOH had no data on specifics.

Public Health

Most of the information on Moldovan health issues was obtained from an interview on April 23, 1993, with Dumitru Sireteanu, Chief of Environmental Hygiene of the MOH's Center for Hygiene and Epidemiology. The Environmental Hygiene Department collects data about public health relative to water-borne diseases: dysentery, fevers, infectious diseases, or any illnesses or abnormalities relative to drinking water. It does not, however, collect data on oncological diseases other than as a national sampling. Mr. Sireteanu said there are no significant differences in the health profile of Prut River basin population versus that in the rest of the country.

Based on data for the period 1990-1992, the Moldovan Epidemiological Research Institute conducted a detailed study on morbidity and mortality of mothers and children under 12. The study revealed serious health problems in people who drink well water in which nitrates exceeded drinking water standards, among them a 60-percent to 70-percent reduction in immune system functioning and a significant reduction in children's intellectual capacity. Other data on the problem came from an MOH letter report to the government dated December 24, 1992, and from a recent annual report of medical statistics prepared by the ministry. For drinking water with excess nitrates, morbidity rates were 3.8 times the national average. The level of underdevelopment or deformities in children was 33 percent versus 10 percent for the rest of the country. Hypertension was 90 percent greater, and cirrhosis of the liver was 5.7 times the level found in Russia.

Further information on public health problems relating to Moldovan environmental conditions came from *Water Pollution Issues in Moldova, Ukraine, Belarus and Russia.*[9] These were some findings:

- An extensive survey done by the Soviet Ministry of Health in 1988 concluded that there is no minimum threshold at which pesticides do not affect health.
- In 1985, the Moldovan death rate from cirrhosis of the liver was seven times the Soviet average.
- Children in Moldova are 30 percent to 40 percent behind their healthier contemporaries in physical development.
- In 1989, Moldova's infant mortality rate was almost twice that of the neighboring and equally rural Vinnitsa region of southwest Ukraine.
- Mental retardation levels are so high that educational curricula in secondary schools and universities has had to be modified.
- The number of special schools for mentally retarded children in Moldova increased from 8 in 1957 to 57 in 1991.

[9] Commissioned by WASH for this study, and prepared by Peggy J. Walker in March 1993.

The USAID Health Profile for Moldova, prepared in April 1992, states:

> The extensive use of herbicides and pesticides in Moldova is a major health issue. This extensive use has impacted the health of Moldova's population. Drinking water has been contaminated by tons of pesticides each year because of improper storage and handling procedures.

2.11 Assessment of Data Availability and Reliability

2.11.1 General

In all three countries, data were generally available, particularly for the purposes of basinwide studies, although recent and ongoing institutional reorganization and the transitional nature of the economies in these countries create some difficulty in defining the nontechnical aspects of the setting. There is, however, extensive technical information. All three countries have a number of large scientific institutions and various agencies that make a serious effort to collect and analyze data and publish statistics.

Country borders and differing languages between and within countries create initial barriers to defining, collecting, and sorting pertinent documents in this basin. Furthermore, in Moldova, certain agencies are headed by and extensively staffed by Russian emigrés, who conduct agency operations solely in Russian and print their official reports in Russian as well. Most of these Russian-speaking officials are not fluent in Moldovan. This situation often complicates data gathering and sharing, and general communications, despite the fact that most senior Moldovan officials are bilingual in Russian and Moldovan.

Data quality appears to vary considerably; however, reliability of data from direct measurement of river water quality or streamflow measurements appears to be acceptable, at least for conventional parameters. There were no indications that drinking water-quality measurements are not reasonably reliable. Most laboratories visited appeared to be reasonably well-equipped and competently staffed. While obtaining reagents is said to be increasingly difficult and expensive, most lab chemists said this was not yet a serious problem for them. In fact, laboratories were among the best parts of most facilities inspected.

While many laboratories can probably measure most parameters for the quality of wastewater effluents reasonably accurately, occasional reviews of reported results suggest that the quality of treatment removal processes is sometimes exaggerated. Officials admit that this practice, which was based on fears of reporting results below those required by regulations, was not unusual in former years. Some evidence suggests that these old practices may linger on.

Instrumentation for monitoring analytically difficult parameters such as trace organics is known to be lacking in the three countries, or existing equipment is outmoded or in poor condition. Therefore, the completeness of the databases becomes an issue, as certain potential pollutants

are not measured at all. One official stated that his government had the capacity to measure only one-third of the 40 pesticides currently in use.

Discrepancies and contradictions are common in documents, particularly in narrative sections. Even some relatively recent data has become outdated due to a rapidly changing economy. For example, although farm animal populations are said to have dropped significantly in recent years as a result of privatization, available statistics fail to reflect these changes. Data on capital and facility operational costs have received little focus, as is typical for these economies. And the cost data produced seem to be meaningless because of the rapid inflation of many prices, coupled with continuing subsidy of others. Finally, time limitations and budget constraints have probably inhibited the gathering of useful information that otherwise could have been obtained.

In any event, regardless of quality and completeness, available data on the basin can be regarded as sufficient to support pollution studies and setting priorities. The following sections provide more specific comments on the types and sources of data available in the three countries, and indications of data reliability to the extent it could be determined.

2.11.2 Ukraine

Environmental data for the Ukranian section of the basin (the oblasts of Chernivtsy and Ivano-Frankovsk) are found both in the Ukranian capital of Kiev and in the oblast capitals. The data in Kiev, related to health statistics and water quality, tend to be more aggregated.

On visits to the Chernivtsy Environmental Inspectorate of the Ministry of Environmental Protection (MEP), the team discovered that highly detailed information is available. This inspectorate appears to be the focal point for data on public health, water quality, and point-source pollution. Data are computerized with PCs, and work was being done to connect data to a geographic information system module. The MEP's Chernivtsy office was highly supportive of this study. Their computer department is preparing a dataset package that should be reviewed in the next phase and can be incorporated into the computer program for Danube water quality monitoring (DEMDESS) for analysis.

The Ivano-Frankovsk Oblast, where upper reaches of the Prut and the towns of Yaremtcha and Kolomyia are located, was not visited during this study. Although some water quality data is available from Hydromet in Kiev, this oblast should be visited to determine the availability of local data.

2.11.3 Moldova

As Moldova is relatively small (total population about 4.5 million), the agencies in its capital city of Chisinau maintain detailed data on the basin area. The agency Water Consortium Aqua maintains a central computer department that houses databases, although it was impossible to review them because of high fees. Hydromet has a small database on the Prut, which was reviewed. Hydromet data are shared with the Romanian agencies.

2.11.4 Romania

Although the team spent relatively little time in the Romanian part of the basin, a significant amount of data was obtained. In cooperation with the other local agencies, the Iasi regional office of the APE maintains a highly detailed computerized data base on the Prut. The agencies in Iasi proved to be very valuable and cooperative resources. Since the sampling of the main stem of the Prut is done jointly with Moldova, the Romanian data base contains the joint data. It appears to be the more easily accessible. The Iasi APE has jurisdiction over the counties located in the Prut River basin and, therefore, is the focal point for the data. The team's Romanian engineering consultant obtained detailed statistical data from Bucharest on the Prut basin, which included population of cities, farm animal populations, and hydrological data.

2.12 Impact on Danube River

The multiannual mean flow of the Danube is about 6,500 m^3/sec at the point before it receives flow from the Prut. The Prut River's mean flow, which is estimated at around 100 m^3/sec, represents only 1.5 percent of the Danube flow. In terms of any potential impact the Prut River might have on the Danube, such a relatively small amount borders on the insignificant. When taking into account the fact that Prut waters are considerably less polluted than those of the Danube and the fact that the Danube discharges into the Black Sea only 150 km from the point of confluence with the Prut, it seems reasonable to conclude that the Prut's impact on the Danube is negligible.

This conclusion in no way negates the value of efforts to reduce pollution in the Prut. Such efforts are important to the three countries bordering the river and to the approximately 3 million people who live in the basin.

Chapter 3

INSTITUTIONAL FRAMEWORK

3.1 Overview

3.1.1 The Environmental Sector

The comments in this report relative to institutional issues are directed to the "environmental sector," a term sufficiently broad to require further definition. In the discussions that follow, the intent is to focus on the institutional aspects of the environmental sector that relate primarily to water quality of the Prut River and its tributaries, and to the quality of basin groundwaters. Such aspects would include the following:

- Production, monitoring, control, and management of physical factors that degrade water quality, including waste products from domestic, industrial, agricultural, or other sources, whether direct (point) or indirect (nonpoint);
- Consequences of degraded water quality, such as negative impact on public health;
- Government policies related to water quality;
- Agencies established by the various governments to assume responsibility for all of the above.

3.1.2 Transition and Challenges in the Riparian Countries

In the three countries bordering the Prut, institutions and policies have been in transition since 1990. Although new ministries or state committees have been formed to address environmental issues, their leadership and direction are constantly changing. New laws are in the process of being drafted, often as a result of political and public awareness of the dangers of environmental pollution. However, faced with continuing political and economic crises, governments can be slow to react to environmental threats from conditions inherited from their predecessors.

Change efforts have yet to bring about significant institutional reform of the environmental sector. Too many agencies still carry out overlapping and contradictory responsibilities relative to water resources. As well, no clear and forceful government policies supporting environmental cleanup have yet been established. While laws often contain strict language, enforcement tends to be lax. Finally, competition for scarce economic resources serves as a serious impediment to environmental cleanup.

3.1.3 Variations Among the Countries

As noted, the institutional aspects relative to Romania are not addressed in this report. (See *Volume II, Institutional Studies: Bulgaria, the CSFR, Hungary, and Romania*, a part of *Point Source Pollution in the Danube Basin*, WASH Field Report No. 374.)

The Ukrainian and Moldovan institutional frameworks for the environmental and water resource sectors follow practices inherited from the former Soviet Union and bear strong similarities to one another in many aspects.

3.2 Environmental Policies

3.2.1 Form vs. Substance

Following environmental policies inherited from the former Soviet Union, neither Moldova nor Ukraine has significantly changed these policies since beginning its relatively short period of independence. Although strongly favoring the environment in declarations and legislation, these two countries allow industrial and agricultural pollution to continue in order to avoid the substantial investments in wastewater treatment and other solutions required to protect the environment.

Tough environmental laws, often with standards more stringent than those of western countries, are easily and effectively circumvented. Sometimes this is done actively, as in setting charges, fines, and penalties so low they become useless as a deterrent to pollution. Laws are also evaded passively, by not aggressively monitoring waste discharges, by failing to enforce regulations such as pretreatment of industrial wastes, or by unquestioning acceptance of skewed laboratory reports that reflect degrees of treatment required by law rather than actually performed.

3.2.2 Responsibility for Environmental Policies

Responsibility for the development of basic environmental policy rests with the new environmental protection agencies. In Ukraine, the agency is at the ministerial level within the government, while in Moldova, it is a state department established by Parliament. Frequently, members of the parliaments or legislative bodies have a strong voice in setting such policies, often with the support of environmental NGOs. Ultimately, however, the government's executive branch is responsible for the adoption of environmental policy. And, as noted, government interests do not always coincide with those of environmentalists.

3.3 Legislation and Agreements

3.3.1 Moldova

In the past, Moldova's environmental legislation was based on the Soviet model, which contains provisions on environmental protection that are vague, outmoded, and unenforceable. In June 1993, however, a new environmental law was passed that was termed "tough, complete, and basic" by Ion Dediu, Chairman of the Moldova State Department for Environmental Protection and Natural Resources. Based on standards of the European Community and the U.S. Environmental Protection Agency, the draft version provides for

- Legislation similar to that of the current draft Romanian Environmental Protection and Utilization Law, not yet passed in Romania;
- Wording that strengthens the functions and responsibilities of the DEP;
- The establishment and use of an ecological fund relating to the use of fines and sanctions for violations of environmental codes and regulations.

In addition, Parliament recently approved a new Water Code and an Underground Resources Code; passage of a new Forests Code is imminent. Mr. Dediu says Moldova is a signatory of eight international protocols on the environment.

One such protocol, with the Romanian government, relates to cooperation between Romania's Ministry of Environment and Moldova's DEP on taking inventory of pollution loads going into the Prut River. The protocol calls for joint sampling; joint assessment of problems; attendance at joint meetings, workshops, and conferences; and assurance of scientific cooperation and collaboration for environmental protection and data exchange. Moldova also has an agreement with the Ukraine on the management of the Prut and Dneister rivers and the Danube delta. (Mr. Dediu represents Moldova as a Task Force Member of the Danube River Environmental Program.)

3.3.2 Ukraine

Also operating largely under laws set up under the Soviet Union, Ukraine has a general environmental legal system similar to that of Moldova. There are two types of legal instruments: general laws and specific codes. The general law is an umbrella under which specific codes are written by the technical agencies involved; codes can be amended more readily than laws. These are the current codes and laws governing water use:

- Ukraine State Administrative Code, which contains the Water Code (1972). Sections 59 and 60 refer to water-use regulations.

- State sport-fishing regulations, under the Ministry of Fisheries, which have specific regulations relating to water quality for rivers.
- State air-pollution law (1993).
- Animal and wildlife protection law (1993).
- Auto-emissions standards.

In its Country Strategy Review for the Ukraine (October 1992), the World Bank states that current water quality program regulations form a complex of factors making the regulations difficult to administer and also sustaining the presence of "pollution havens." Such havens consist of areas where a number of industries (1) are sampled at a point that understates the pollutional load, (2) have maximum allowable concentrations (MACs) that allow for dilution factors rather than reflecting discharges at the end of the pipe, and/or (3) are fined routinely but in amounts far too low to serve as a deterrent.

Ukraine has international agreements with both Moldova and Romania for monitoring water quality in the Prut River.

3.4 Water and Environmental Sector Organizations

3.4.1 Moldova

State Department of Environmental Protection and Natural Resources (DEP)

DEP was established in 1990 by absorbing functions from the Ministries of Forestry, Water Resources, Geology, and Ecology. The department reports, not to any governmental ministry, but to the legislature through a parliamentary committee on environment. Its primary duties are to

- Recommend environmental policy and legislation to Parliament and represent Moldova in all environmental matters;
- Monitor environmental pollution in air, water, and soil, and protect Moldova's flora, fauna, and forests;
- Review applications from all "enterprises" (municipalities, industries, farms) for water extraction and wastewater discharge, set limits on the amounts and costs of such extractions and discharges, and set penalties and fines for uses and discharges exceeding the approved limits; and
- Conduct routine environmental monitoring and sampling for water, soil, and air, and inspect water-using enterprises for permit violations through a network of 11 regional "Ecological Inspectorates."

Being responsible for implementing most of the DEP's responsibilities relative to water quality, the central and regional inspectorates are organizations of considerable importance.

Water Consortium Aqua (Aqua)

Formerly a part of the State Committee for Water Resources, Aqua became a state holding company under the government reorganization. It serves under and reports to the Ministry of Agriculture and Food Industry. Aqua has divisions for construction, dams and reservoirs, bulk water supply and transport, canal systems, and operations and maintenance.

Aqua's primary duties include the following:

- Coordinating and managing all large untreated surface-water systems, with emphasis on agricultural use;
- Managing pump stations, wells, canals, and water transport for agriculture, including 40 major bulk consumers for agricultural irrigation;
- Maintaining records on water balance (extraction and return flow) in water bodies and rivers and maintaining records on all water consumers that use more than 100 m^3/day;
- Preparing master plans for water quantity and water use, and designing facilities to be constructed for other agencies (such as the Ministry of Community Services);
- Reviewing applications from all water-extraction enterprises to ensure the availability of requested amounts at the proposed location.

Ministry of Community Services and Utilization of the Housing Fund (MCS)

This ministry has several English-equivalent names: Public Works, Public Services, Communal Services, Local Services, and Public Utilities. MCS was reformulated in September 1990, when government services were reorganized, and again in September 1992. MCS has no current published organizational chart. It is responsible for the following:

- Policy and direction for local administration, and overall economic strategy for local government;
- Local government services for unincorporated villages and local organizations;
- Communal services such as solid wastes, water, wastewater, streets, and lighting for cities, towns, and urban villages;
- Government subsidies for local services.

With particular reference to water and wastewater services, MCS performs the following tasks:

- Establishes norms and standards for water and wastewater services;

- Conducts long-term planning for water and wastewater services (designs are prepared by a division of Aqua);
- Supervises the operation and maintenance of water and wastewater utilities for cities and towns;
- Establishes charges for water and wastewater services.

Hydrometeorology Research Institute (Hydromet)

Believed to be a research institute, Hydromet carries out these functions:

- Researching and implementing surveys on water, soil, and air;
- Forecasting hydrological flows for agricultural purposes and assisting Aqua in allocating water among competing users;
- Sampling and monitoring river water, including the Prut at three locations;
- Maintaining a computer data base of the data it collects.

Ministry of Agriculture and Food Industry (MOA), Wastes Section

The Wastes Section of the MOA maintains information on the location, type, and size of animal farms, and on the types of systems used to treat wastes from these farms. It also keeps records on wastes from the country's various food processing industries.

State Association of Production and Investigation of Geology and Topographic and Geodesic Surveys (AGeoM)

The functions of AGeoM include the following:

- Conducting investigations to assist in extraction of groundwater for potable use, and also in mineral extraction;
- Executing drilling projects;
- Conducting geoecological operations;
- Carrying out studies and research on seismicity and deep geological structures;
- Conducting topographical surveys and preparing cartography for its own internal use;
- Updating "service" (geological) maps;
- Serving as a data bank for geographical names, and assigning names as required;
- Conducting special research in all aspects of geology and hydrogeology.

Relative to water resources, AGeoM has information on groundwater aquifers and the chemical quality of groundwaters. When enterprises request permission to extract groundwater for their use, they submit these requests to AGeoM for their review and approval.

Ministry of Health: Department of Hygiene and Epidemiology (MOH/HE)

The Department of Hygiene and Epidemiology is charged by MOH with the following two major responsibilities:

- Collecting public health data relative to waterborne diseases
- Sampling and testing drinking water quality.

The department maintains records on both water quality measurements and public health statistics. It also samples and analyzes water from Moldova's major rivers, including the Prut, which is said to be sampled quarterly at six stations.

3.4.2 Ukraine

Ministry of Environmental Protection (MEP)

Recently upgraded from a state committee to a ministry, the MEP has undergone several leadership changes over the past few years. Its primary duties include the following:

- Developing and enforcing policies, laws, and regulations related to environmental protection
- Monitoring various factors affecting the environment, through the following departments:
  - Environmental Monitoring
  - Nuclear and Radiation Safety
  - Natural Reserves and Recreational Lands
  - Complex Problems of Ecological Safety in Industry, Power, Construction, and Transportation
  - Problems of Agriculture, Industry, and Bioresources
  - Nature Use and Regulation
- Monitoring water use and wastewater discharges through the Water Resource Management Section, which directs the efforts of the regional (oblast) water inspectorates that are directly responsible for monitoring enterprises extracting waters and discharging wastewaters

The Water Resource Management Section and the Chernivtsy Regional Water Inspectorate are key organizations within the MEP relative to water quality and pollution studies of the Prut River. They coordinate closely with the SCWRU (see next section) in water resource allocation and in the permit process for water users.

State Committee for Water Resources of Ukraine (SCWRU)

Somewhat lower in the hierarchy of government than ministries, state committees are nonetheless independent organizations that do not report to ministries. In water resource matters, the SCWRU is the most important governmental organization. Its principal responsibilities include the following:

- Monitoring and controlling water utilization and quality;
- Collecting and analyzing samples from water bodies;
- Collecting data and maintaining computer data base records of water use, water quality, and wastewater discharges;
- Locating and identifying pollution sources and forecasting estimated contamination levels;
- Evaluating water balances, comparing forecast water flows at various times of the year against estimated water extractions;
- Preparing reports on its activities for interested government agencies;
- With the MEP, jointly allocating water resources to all water users in the country;
- Managing the permit process under which water users receive approval to extract water and discharge wastewaters.

State Committee for Housing and Community Services (SCHCS)

Although the team did not visit this organization, it is believed to be very similar to the MCS in Moldova (described previously).

SCHCS is responsible for a wide range of municipal services. In regard to water and wastewater services, it establishes standards for water and wastewater services; conducts long-term planning for water and wastewater services; supervises the O&M of water and wastewater utilities for cities and towns; and establishes charges for water and wastewater services.

The relationships between the managers of water and wastewater systems, who are believed to be SCHCS employees, and officials of cities in which the systems are located are unclear. In general, however, it appears that municipalities have a relatively limited voice in how SCHCS services are provided.

State Committee for Hydrometeorology (Hydromet)

Hydromet has several major departments: Chemical Pollution (which supervises the laboratories); Meteorology; Radiation and Ecological Control; Engineering and Technical Supply; Hydrology and Water Cadastre (rights or ownership); and Data Management.

Among Hydromet functions important to the study of the rivers are these:

- Sampling all rivers, lakes, and reservoirs through a network of 244 observation posts. Sampling frequency depends upon the importance of the water body and varies from daily (important) to four times a year (least important).
- Maintaining a central laboratory in Kiev and 10 regional labs throughout the country.
- Sampling water quality of water bodies. It does not, however, sample wastewater discharges.
- Publishing an annual report (in 32 copies) on its activities and the data it collects, except stream flows.
- Publishing annual reports on stream-flow data separately from the basic annual report.

Ministry of Health: Sanitary Inspection of Ukraine (MOH/SIU)

The importance of this department is indicated by the fact that its director is also a deputy minister of health. Like Moldova's Department of Hygiene and Epidemiology, MOH/SIU has two basic functions:

- Collecting data about public health relative to waterborne diseases
- Sampling and testing drinking water quality.

The department maintains records on both water quality measurements and public health statistics. It is unclear whether staff sample and analyze water quality from the rivers, lakes, and reservoirs of Ukraine.

Scientific Hygiene Center (SHC)

Responsible to the MOH, the SHC conducts epidemiological studies relating to environment and health. The center is concerned with environmental safety, the national genetic pool, environmental health, national nutrition and medicine, and the medical aspects of the Chernobyl accident. It is very focused on studying health problems within the population stemming from Chernobyl radiation, and appeared to have little significance relative to the Prut River studies.

3.5 Permits for Extracting Water and Discharging Wastewater

From extensive discussions with responsible agencies in both Moldova and Ukraine, it appears clear that in each country the national environmental agency and the national water resources agency collaborate very closely in the permit process and share responsibilities. It was less clear exactly how this sharing takes place.

3.5.1 Moldova

In both Moldova and Ukraine, the systems used to control the water extraction and wastewater discharge are very similar. This system is essentially the one developed and used by all republics of the former Soviet Union. The following description of the permitting and reporting procedures came from the chief water inspector of the State Department of Environmental Protection:

Every "enterprise" (municipality, industry, agricultural or animal farm, or other business) wanting to extract water from any of Moldova's ground or surface waters, and/or to discharge wastewater to any water body, must obtain formal approval from the government. This applies to first-time users as well as to those reapplying after initial approval periods have expired.

The applicant must indicate the purpose for which the water is to be used, the amounts required, the size or extent of the business, the source from which the water is sought, and other applicable data. The applicant also must indicate how the used water or wastewater is to be disposed of, including details of treatment and the river body into which the waters are to be discharged.

The applicant must obtain prior approval (usually in the form of an official signature on the permit application) of a wide variety of organizations, indicating that they have no objection to the request. Typical ministries or agencies on the list of required approvals include Health, Hydrogeology (if wells are involved or groundwater might be affected), Veterinary (if livestock are involved), Fish Culture, and Mining, among others.

Together with necessary signatures or approvals, the completed application is then reviewed by the Water Inspectorate to determine whether the amount of water requested is reasonable for the type and size of business proposed, and whether the proposed means of disposal and degree of treatment is adequate for the particular stretch of water body into which the wastewater is to be discharged.

Fees are then determined for the proposed amount of extracted water and for the proposed amount and strength of discharged wastewater. These fees vary widely depending upon the type of enterprise and the area of the country and individual water bodies involved.

The permit process was said to require anywhere from one month for reapplications to three months for new applications. Given the apparent complexities and number of approvals required, these time periods appear rather optimistic. The chief water inspector said that most applicants employ specialists to help them through the permit process.

Once a permit is obtained, the user/discharger must conduct periodic sampling and measurement of the water extracted and discharged. These data are summarized in standard forms and submitted annually to the Water Inspectorate. Although this information is said to be verified independently by the inspectorate, given the large number of users and the government's limited manpower, transport (said to be the most critical problem), and laboratory capacity (second most critical problem), it seems clear that independent verification is limited.

If a user/discharger reports having used more water than the permitted amount, or having discharged larger pollution loads to water bodies than those listed in the permit, fines are assessed. In general, the fines are based on multiples of the basic fees, and the multiples increase as the percentage of excess rises. Since the basic fees are very low, however, such fines constitute a minimal deterrent.

As the data are reported by the users and verification procedures are suspect, the reliability of the information presented in the forms is also suspect. Nevertheless, the forms do indicate the nature and location of all Moldavan water users and do give some indication of the extent of water use and wastewater discharges.

All data presented on the forms is entered into a computer data base and can be accessed. The inspectorate's copy of the 1992 data, printed out in early March 1993, was available for review for all of Moldova; summary data are presented to interested government agencies. The computer data base is maintained by the Water Consortium Aqua, and is said to be available also from the Romanian data base maintained in Iasi.

3.5.2 Ukraine

The Ukrainian system appears to be essentially the same as that used in Moldova, with perhaps some differing aspects or a somewhat different emphasis. The following comments are based on an interview with the head of water monitoring for the State Committee for Water Resources of Ukraine:

As the basis for the data it collects, the SCWRU uses a two-sided form called "State Statistical Report." Every enterprise extracting water and/or discharging wastewater to the country's water bodies (surface or ground) must complete this form annually. The form provides the name of the enterprise (whether municipality, industry, farm, or commercial entity), the total water extracted the previous year, and the source (river, lake, or wells) from which it was taken. The form also indicates the total amount of wastewater discharged, where it went, and its composition from a range of pollution parameters including BOD, suspended solids, phosphates, nitrogen, chlorides, and so forth.

At the beginning of each year, water users fill out a similar (but simpler) form estimating the amount of water they plan to use and the amount and quality of the wastewater that will be discharged.

The "long" form, completed at the end of the year, appears to be very similar to those currently in use in Russia. The information provided is based on measurements and analyses conducted by the water user or someone hired. However, the SCWRU periodically checks these data by conducting its own measurements and analyses. Users were said to report samples taken as often as monthly, and the SCWRU was said to verify the data as often as every three months. Other officials questioned whether samples were taken with such frequency.

Data are entered into a mainframe computer at SCWRU, said to be an IBM 360 "type" (possibly called a "Yas" or "Bolshoi"), using a data base program called "FoxBASE+." SCWRU can access the mainframe with personal computers (PCs) and gave a demonstration using a 286, 20MHz, 1MB RAM, 40 MB hard disk PC.

It was unclear whether staff were entering both reported data and data they were collecting and analyzing themselves for verification purposes, or, if both, whether they were able to differentiate the data. (From previous WASH experience in Russia, some people questioned the extent to which the government actually verified the results reported by others. Some officials in Russia asserted they had neither the capacity nor the inclination to carry out a significant program of verification. Future users of such data should pursue this matter further.)

The team saw two computer programs. One appeared to be a simple, very generalized program in which data were shown as average, maximum, and minimum levels for the entire year, as opposed to individual sampling. The program appeared to be of limited value, and the operator was unable to bring up any data related to either the Prut River basin or the city of Chernivtsy.

In another department, the PC was linked to the mainframe and appeared able to access all the data it contained. With considerable effort, one could get the data. The sorting process appeared cumbersome, however, as one could not sort initially by river basin or even by oblast or region, but only by extractions or discharges. Choosing the latter, the PC operator eventually got to Chernivtsy, where 67 water-discharging enterprises were listed. Because the listing was by code, the operator had to insert a diskette to determine that the code number (14933, for example) was the municipal wastewater treatment plant at Chernivtsy. Six pollution parameters were listed for 1992: BOD (total annual load): 267 metric tons, petroleum wastes: 0, suspended solids: 215 tons, "total salts" (assumed to be TDS): 3,963 tons, sulfates: 623 tons, phosphates: 5,162 kg, and chlorides: 1,600 kg. For river-flow data, one had to look elsewhere, and some of the flow measurements appeared illogical. Pollutants were given as annual totals, and it was unclear how one accessed individual sample data or if it was even possible to do so.

Although the data are published annually, the most recent publication was for 1991. A very limited number of copies (under 20) are published and distributed to other government offices. Data for 1992 were available in computer printouts dated April 1993. To obtain a copy, formally request the "1992 Annual Report on Water Utilization" from:

Victor M. Horiv, Director
State Committee for Water Resources of Ukraine
8, Chervonoarmijska Street
252601 Kiev, Ukraine

3.6 Charges for Water and Wastewater Services

3.6.1 Moldova

User Charges

In Moldova, the cost of water and wastewater is highly subsidized, with rates proposed by the MCS. Although meters appear at dwelling entries (but only one per apartment building), they are not used for billing purposes. Water cost per family is based on the consumer's living space, not including common space. For residential users, the water charge is currently 13 kopecks per m^2/month. For the average family, with 30 m^2 of floor space, this amounts to a monthly cost of about four rubles[10]. A one-room flat averages 14 to 20 m^2 in size, a two-room flat from 27 to 32 m^2, and a three-room flat from 39 to 45 m^2. These are internal dimensions and do not include common spaces such as halls. The ministry's recommended tariff increase—by a factor of 16, to 2.10 rubles per square meter—would bring the average family's bill to about 63 rubles per month, or about 2 percent of the minimum monthly wage levels as of April 1993.

Revenue Policy

At present, no national laws limit the level of tariffs charged for water and wastewater services. The government's basic policy is said to be that residential users should not have to pay the full cost of system operations, but that industrial and commercial users should pay at much higher rates. A cursory examination of fee schedules in several cities indicated that industries pay 30 to 40 times the rate charged to residential users.

3.6.2 Ukraine

In Ukraine, fees for bulk water supply are set by a pricing committee in the Ministry of Economy, under the Council of Ministers. Fees, based on cubic meters of water taken, vary by river basin. Retail prices that municipal water utilities charge to customers are set by the municipal officials, but these fees must be within limits set by the central government. No information on domestic and industrial charges for water was obtained in Ukraine.

---

[10] Moldova uses both its own transitional currency, called coupons, and Russian rubles. The two currencies are used interchangeably. As of April 1993, the exchange rate was US $1.00 = 820 rubles or coupons.

3.7 Monitoring and Enforcement

3.7.1 Moldova

In Moldova, the Ecological Inspectorate of the DEP (DEP/EI) is responsible for the monitoring and enforcement of water use and of wastewater discharges and other sources of pollution. To carry out these responsibilities, the EI calls upon its water and pesticides sections and occasionally other inspectorates. There are 10 regional inspectorates and one central or chief inspectorate to monitor the country's 40 districts. Four of the regional inspectorates have laboratory capacity. In the Prut River basin are three regional inspectorates: at Edine, in the north; Ungheni, in the center; and Cahul, in the south.

The regional inspectorate in Ungheni has 10 staff members spread among an administrative unit and three operating sections: Water and Air; Soils, Chemicals, and Other Wastes; and Flora and Fauna. When operational, the planned laboratory would become another section. This inspectorate's Water and Air Section monitors these areas:

- *Water Use*: Nine water intakes on the Moldovan side of the Prut extract water for municipal, industrial, and agricultural purposes. Total water extractions are said to amount to 40 million m^3/year (110,000 m^3/day or 1.3 m^3/second). Agriculture accounts for 60 percent of water extractions.

- *Wastewater discharges*: According to the inspectorate, there are 47 wastewater treatment facilities of all types in the region, with capacities ranging from only 100 m^3/day up to the 15,000 m^3/day of the Ungheni municipal treatment plant. Total discharges from all these plants were said to be 5 million m^3/year, or 13 percent of the water extracted, but that total is less than the reported capacity of the Ungheni plant alone.

  Samples are taken from the discharge pipes of the wastewater treatment plants at least monthly, and sometimes two to three times a month. Inspectors check raw sewage influent to the plants as well as the wastewater quality after treatment, and they sample both points at the same time. Five of the municipal plants sampled have their own labs: Ungheni, Falesti, Pirlita, Glodeni, and Cornesti. The other plants contract with government labs to analyze their samples. The Ungheni Inspectorate reportedly verifies the accuracy of the results reported by all 47 plants.

- *Prut River Quality*: In a joint program with Romanian authorities in Iasi, the inspectorate takes monthly samples from three stations on the Prut River: Valea Mare, Ungheni, and Sculeni.

- *Agricultural and Industrial Discharges*: The inspectorate does not sample agricultural drainage waters, since "they recycle their wastes." Neither does it sample industrial wastes that discharge to municipal sewers (said to be after pretreatment); that is considered the responsibility of the wastewater utilities. There is no program to sample or analyze nonpoint-source pollution.

3.7.2 Ukraine

The Water Resource Management Section (WRM) of the MEP has responsibility for monitoring and enforcing water use and also wastewater discharges and other sources of pollution. Although its main office is in Kiev, the WRM's field work is delegated to regional environmental inspectorate offices of MEP/WRM throughout the country.

The inspectorate at Chernivtsy is responsible for conducting environmental monitoring and inspections related to the portions of the Prut River within Chernivtsy Oblast. Although a portion of the upper basin lies within Ivano-Frankovsk Oblast, the major polluters are in Chernivtsy. The inspectorate is headed by the chief of inspections and laboratories, who supervises 11 monitoring districts with a local inspector in each; inspection teams for water, soil, and air; and laboratory sections for water, soil, and air. The following indicate the Chernivtsy inspectorate's range of activities:

- *Duties*: The inspectorate conducts routine sampling and laboratory testing of all water users and wastewater dischargers within its region. The staff work interchangeably in the inspection section, taking samples from all areas. A team approach is used to gather samples and inspect, involving one person from the laboratory, one from the inspector's unit, and one from the enterprise under inspection. At the treatment plant or industry, this team takes samples above the water intake or discharge, below it, and at the pipe itself. They also inspect the industrial processes to see if prior agreements on pollution corrections have been carried out. Samples are taken and comparisons made with the site-specific standards agreement.

- *Fines and Sanctions*: These come about through violations of formal signed agreements between the water users and the government. Such agreements are based on a maximum allowable load formula that takes into account in-stream water quality/dilution and pollutional loads as measured by various parameters. Fines are also levied when a correction order is placed to improve an industrial process (a leak, something out of order) within a time limit and the correction has not been made.

- *Laboratory*: The inspectorate's laboratory is divided into three sections: air, water, and soil. The lab has the capacity only for routine tests (although there appeared to be some very specialized equipment in the director's office that was not for regular or general use). Staff are unable to test for pesticides or organic solvents at the lab, but do have access to these tests through the State Agrochemical Laboratory, where there is a special section on toximitry. Currently, research is taking place at this lab, which will lead to decisions on maximum allowable pesticide use.

- *Types of Enterprises Monitored*: As part of its workload, this inspectorate inspects 75 primary water polluters that discharge wastes directly to water bodies (mostly rivers) in the oblast. Of these entities, 11 are municipal wastewater treatment plants, 62 industries, and two sugar processing plants. The industries noted do not include those discharging their wastes to a municipal treatment plant after (or without) pretreatment.

3.8 Major Institutional Issues

Most of the major institutional issues identified in the following section are common to Ukraine and Moldova. (Many of them may apply to Romania as well, but that country's institutional issues have been addressed in another study.) Because these issues are so serious, genuine pollution reduction in the Prut River is unlikely to proceed until most of them are resolved.

1. Unclear National Policy on Environmental Protection

Even when the policies of individual environmental protection agencies are clear, they are sometimes undermined by the national government's support of agricultural and/or industrial interests that oppose or violate those policies, or by the government's failure to support meaningful enforcement measures against polluters.

2. Environmental Agencies' Lack of Adequate Authority

From the many examples of inadequate pretreatment of industrial or farm wastes, it is clear that environmental agencies lack the necessary authority (tough laws with strong enforcement provisions) or capability (adequate staff and facilities) to carry out their responsibilities.

3. Unclear or Inappropriate Assignment of Responsibilities

Several agencies appear to have similar responsibilities around such functions as water allocation and sampling and testing for water quality. Some duplication is warranted, such as a water system's need to test its water quality to ensure that its processes are operating properly and health officials' corresponding need to ensure that the quality meets potability standards. Nevertheless, this issue warrants further study.

4. Unrealistically Low Fines and Penalties for Pollution

Current fines and penalties for exceeding allowable discharge levels are far too low, and probably cost more to collect than the penalties themselves. Thus, it becomes more economical for polluters to pay the fines than to take corrective measures.

5. Inadequate Pricing of Water and Wastewater Services

Fees charged to water-using enterprises both for the water itself and for wastewater discharge are extremely low, far below the costs of providing those services.

6. Unrealistic Wastewater Treatment Standards

Some agencies establish unrealistically high standards for wastewater treatment. Such high standards often add little to pollution control, would add unnecessary costs, if achieved, and lead to tendencies to exaggerate reports of treatment for fear of punishment.

7. Inadequate Monitoring of Pollution

Many central and regional environmental inspectorates have too few staff with the required skills and must cope as well with inadequate or outdated laboratory facilities. Often, these inspectorates also suffer from totally inadequate means of transportation.

8. Little Coordination among Government Water Agencies

Several agencies with water-related responsibilities appeared unaware of other agencies' activities that should have been of interest to them. For example, activity reports from the various agencies tended to have very limited distribution. (This issue relates to #3.)

9. Too Little Coordination Among Riparian Countries

Coordination between Moldova and Romania appeared to be fairly good, while contacts between both those countries and Ukraine appeared inadequate. As the country where the Prut originates, Ukraine may have less interest in the river's downstream condition. However, the lack of communication also probably relates to the difference in languages. Whatever the reason, coordination among all countries sharing the basin needs to be improved.

10. Nonsupport for Pollution Cleanup

A program depending only upon penalties and fines for pollution reduction is unlikely to be successful. Instead, governments should explore ways to provide positive support for cleanup, such as possibly helping polluters plan lower-cost facilities, allowing them a reasonable period to meet realistic treatment standards, and to the extent possible, providing some form of financial support for the required facilities.

Chapter 4

IDENTIFICATION OF HOT SPOTS

4.1 Criteria for Selection

The identification of high-priority pollution problems, or "hot spots," can be based on criteria related to public health and to protection of aquatic life and economic values, either within the Prut River basin or as it affects the Danube. (As noted in Section 2.12, the Prut's impact upon the Danube is negligible.)

Within the basin itself, protection of drinking water and public health is considered the most important factor in selecting pollution hot spots. Already a direct and indirect source of drinking water with greatly increased use expected in the future, the Prut also serves as a principal source of irrigation water. As such, it is critical to the economic well being of this primarily agricultural basin.

Hot spots may require physical solutions such as new or upgraded treatment facilities or the cleanup of toxic or hazardous waste sites. Many times, however, a better course might be to minimize pollution at the source by making institutional changes (effective fines and penalties, control over types and amounts of pesticides used) or by modifying certain processes at industrial plants to reduce the pollutants in waste streams.

4.2 Romania

In the Prut River basin, the city of Iasi is the most significant pollution source affecting the tributaries of Bahlui and Jijia and the Prut itself. Within Iasi are several closely related problem areas.

Iasi Municipal Wastewater Treatment Plant

Even now a seriously overloaded plant, its expansion has been halted because of limited funds; for the short term, efficient blowers and diffusers are the highest priority items. Much of the overloading comes from inadequately treated industrial and pig farm wastes, as noted in the new two sections.

The Tomesti Pig Farms

Several years ago, facilities were constructed for complete secondary treatment (sludge digestion and drying beds) of wastes from these co-located pig farms. Now, however, only primary sedimentation is being practiced, with raw sludge discharged to the former drying beds. The rest of the facilities appear to be in poor condition and in a state of abandonment.

The poorly treated wastes are then discharged to the city sewage system, adding significantly to its existing problems.

Providing adequate and separate treatment for the piggery wastes, with reuse and/or direct discharge to the Bahlui, may be a viable alternative to using the municipal wastewater system.

Inadequate Treatment or Pretreatment of Industrial Wastes

In the Iasi area, some industrial plants treat their own wastes and discharge effluents directly to the Bahlui and possibly the Jijia. Many other plants provide only pretreatment and discharge their effluents to the city sewage system. While no hard data on the magnitude of the problems was collected, talks with local officials and observation of the condition of receiving waters indicate that serious problems exist with both situations. The impact of pharmaceutical wastes and the ultimate disposal of wastewater sludges were specifically mentioned as problems.

4.3 Ukraine

The city of Chernivtsy and its industries are also an important pollution source in the basin. Like Iasi in Romania, Chernivtsy's problems are closely related.

Chernivtsy Municipal Wastewater Treatment Plant

This plant receives a great deal of industrial wastes that have received inadequate pretreatment. Although the plant is being expanded, insufficient funds keep the construction pace very slow. Currently, the sludge from this plant is stored in very large lagoons. Sludge dewatering facilities are also under construction. Study of the treatment processes selected and the facilities under construction points to a need to critically review the current planning and design concepts.

Inadequate Treatment or Pretreatment of Industrial Wastes

Local authorities believe that industries, particularly metal finishing industries, seriously affect the Prut, an assessment supported by the water quality data. The problem is believed to lie with those plants providing treatment and direct discharge, as well as with those providing pretreatment and discharge to the municipal sewers.

4.4 Moldova

Moldova's potential hot spots relate to possible damage to surface and groundwaters from very heavy pesticide and fertilizer application. A related problem could exist in the widespread storage of environmentally unacceptable pesticides in farms throughout the country. Another possible source of hot spots could be the industrial waste lagoons maintained by the DEP.

Applied Pesticides

In the Moldova portion of the basin, the most serious concern is health problems believed to originate in drinking water contamination. Of the area's shallow wells, which are used by most people in the basin, over half have nitrate levels above drinking water maximums. A high incidence of physical and/or mental retardation in children is one of the more significant findings of health officials.

While direct linkage to the cause could not be determined, many believe that heavy fertilizer and pesticide usage could be contributing significantly to these health problems. Data on contaminants, including pesticides in drinking water, are said to be available but could not be obtained. Some concern was also expressed about the presence of pesticides in agricultural products, but again, no evidence was obtained.

Records dating back to 1977 indicate pesticide levels above allowable drinking water limits in selected reaches of the Prut River. It seems reasonable to postulate that the shallow groundwaters of the basin probably were also contaminated by pesticides being carried by rainwater runoff to the Prut. However, even if data on well-water pesticide contamination are available, the parameters investigated are probably limited because of weaknesses in the monitoring program and the lack of the sophisticated equipment required to test for the various pesticides now in use.

In the Moldovan part of the basin, the highest priority is to define the actual extent and impact of the pesticide problem, using modern equipment and investigative methods to determine whether this problem constitutes a hot spot.

Stored Pesticides

Substantial amounts of pesticides that can no longer be legally imported are being stored at farms throughout Moldova (see Table 5); these stored pesticides could be considered widely spread mini hot spots. Serious consideration should be given to collecting these dangerous pesticides for safe removal, and replacing them with environmentally acceptable products.

Industrial Waste Lagoons

In Moldova, each industry is said to be responsible for maintaining, on site and safely, any hazardous wastes it generates; the DEP/EI maintains a register of such sites. DEP/EI itself is also said to store some 12 million cubic meters of industrial and petroleum wastes in a series of central lagoons. No data were seen on either industrial or DEP/EI waste storage facilities, but they may constitute a great enough threat to the environment to be considered hot spots.

At a minimum, the volume and type of wastes stored, the storage conditions, and the site locations should be inventoried. As well, there should be pilot testing of selected sites to determine the extent of the threat these facilities pose to the environment.

Chapter 5

CONCLUSIONS AND RECOMMENDATIONS

5.1 Critical Environmental Problems

The most critical environmental problems affecting Prut River pollution vary by country. In Ukraine and Romania, these problems stem largely from inadequately treated industrial and municipal wastewaters from their large cities. In Moldova, the problems are mostly agricultural in nature, resulting from high fertilizer and pesticide usage. Conclusions and recommendations relative to these environmental problems follow in the next section. If environmental problems are to be solved, however, institutional weaknesses in the environmental sector must also be remedied. Conclusions and recommendations relative to these issues appear in Section 5.3.

5.2 Guidelines for Pre-Investment Studies

5.2.1 Investment Projects: Ukraine

Priority Project

The existing Chernivtsy municipal wastewater treatment plant provides treatment for about 70 percent of the population of 260,000; however, this treatment is inadequate. A 75-percent increase in capacity is under suspended construction, but before financing completion of the construction, plans should be revised to ensure that industries provide adequate wastewater pretreatment and that the proposed facilities are suitable.

Other Projects

Other significant pollution sources requiring upgraded treatment facilities include two other sources that should be investigated to determine whether either or both should be upgraded to priority status:

- Several polluting enterprises at Novaselitsa (about 30 km downstream from Chernivtsy), including food processing plants, an alcohol factory, and poultry processing facilities. These enterprises are said to use "primitive treatment facilities" before discharging wastewater effluent to the Prut. In addition, a new meat processing plant is also proposed for this area.
- Two sugar beet processing plants. Both discharge wastes, after inadequate lagooning, to the Cherlena and Viliya rivers, tributaries of the Prut.

5.2.2 Investment Projects: Romania

Priority Project

The existing Iasi municipal wastewater treatment plant in the Tomesti area of the city provides treatment for most of the population (450,000) and for extensive industrial wastes. The plant is overloaded, with inefficient and poorly functioning equipment and outmoded technology. Much of the overloading results from inadequately treated industrial wastes discharged to city sewers. Although improvements were planned to increase plant capacity from 365,000 m^3/day to 450,000 m^3/day, the estimated cost of US$14 million is said to be beyond the city's financial capacity. Before financing completion of the expansion, plans should be revised to ensure that the industries provide adequate pretreatment of wastes and that the proposed facilities are suitable.

Priority Project

Wastes from the 270,000 pigs in the Tomesti area now receive only rudimentary sedimentation before being discharged to the city sewers, obviously contributing greatly to the problems of the Iasi treatment plant. Improvements to the pig farms' existing treatment works should be studied in conjunction with the study of the municipal treatment plant. Alternatives such as improved pretreatment or complete treatment and direct discharge to the Bahlui River should be considered.

Other Projects

In addition to the city treatment plant and the pig farms, two other pollution sources in the Tomesti area should be investigated to determine their relative priority:

- Air pollution from the coal-burning thermal power plant that provides central heating for the city. This large plant has a waste gas chimney only half the designed height, an "economy" measure taken by former officials.
- Solid waste pollution from the city's open garbage and trash dump. The dump receives all solid wastes collected in the municipal area, with no efforts made to provide cover as a landfill.

Proposed Study

Another problem warranting study relates to rural water supplies. Of 82 villages in the Iasi Judet, only 10 percent have piped water systems. In the other villages, people depend upon shallow wells (10 m) for their water, which is very high in nitrates. Those using this water are said to suffer from a variety of health problems. A study should be undertaken to determine the source of the nitrates or other possible contaminants, and to consider alternatives for solving this problem.

5.2.3 Investment Projects: Moldova

Priority Project

At farms in over 50 locations throughout Moldova, approximately 1,200 tons of environmentally unacceptable pesticides are being stored; of this amount, 334 tons are stored in the Prut basin. Failure to remove these pesticides promptly will have two adverse consequences. One is that some of these pesticides will find their way into local groundwaters because present storage conditions often provide no protection from the elements. The other possibility is that farmers may be tempted to apply these pesticides to their crops. A program should be initiated to purchase these stores (or replace them with appropriate pesticides) and then dispose of them safely.

Other Projects

Some 30 animal farms—raising cattle, pigs, and poultry—operate in the Prut River basin. Authorities indicate that existing treatment processes are unsatisfactory, particularly for pig farm wastes. A possible project would be the selection of two farms of each type for a pilot project to determine the most effective means of treating these animal wastes. The project would include the study, design, construction, and operation of the pilot facilities.

Proposed Study

Over half the shallow wells in the basin have nitrate levels above allowable limits for potable water, and many users have serious health problems. Heavy pesticide and fertilizer applications in the past may be a factor in this area's high nitrates and health problems. A detailed study is recommended to determine the relationships among poor well-water quality; the use of pesticides, fertilizers, and herbicides; and serious health problems.

Proposed Study

Industries maintain storage on site for any hazardous wastes generated. The DEP's Ecological Inspectorate also stores some 12 million cubic meters of industrial and petroleum wastes in a series of central lagoons. These industrial and DEP waste storage facilities may constitute a threat to the environment serious enough for them to be considered hot spots.

Although the inspectorate maintains a register of such sites, it would be wise to inventory the volume and type of wastes stored, the storage conditions, and the location of all such sites. Pilot testing of selected sites should be conducted to determine the extent to which these facilities threaten the environment.

5.3 Institutional Improvements

Conclusions and recommendations for institutional strengthening relate to major institutional issues identified in Ukraine and Moldova, many of them common to both countries. (Some of these may also apply to Romania, but Romania's institutional issues were addressed in another study.) These issues are serious enough to largely derail pollution reduction in the Prut River until most have been resolved. Within this section, each conclusion is noted and immediately followed by a recommendation.

1. The national policy on environmental protection is either not clearly stated or not fully supported by the government.

   Such policy should be made clear and comprehensive; the government should instruct all ministries and agencies to act in accordance with that policy and should vigorously support the agreed-upon environmental policy.

2. Environmental agencies lack authority and power.

   Legislation should be enacted giving these agencies clear authority and capability to enforce environmental policy, with power to levy fines and penalties for noncompliance at levels making cleanup the only alternative to punitive financial charges or closure.

3. Responsibility for environmental protection is sometimes unclear because of conflicts among agencies.

   A study should be conducted to compare the various agencies' functions such as water allocation and quality sampling and testing. Some duplication is warranted, such as a water utility's need to test its water to ensure that its processes are operating properly, and health officials' corresponding need to ensure that water quality meets potability standards. Nonetheless, a study could recommend reallocation of responsibilities that would minimize confusion and conflicts.

4. Pricing of water and wastewater services is too low to provide incentive to conserve water, or revenue to pay for adequate operation and maintenance of the utilities providing these services.

   A program to gradually increase these costs should be initiated, with a minimum objective of recovering full O&M costs.

5. Wastewater treatment standards are unrealistically high. Such standards add little to pollution control, would add unnecessary costs if achieved, and encourage exaggerated reports of the degree of treatment achieved to avoid reprimands or punishment.

   The requirement that effluents meet standards of 5 mg/l BOD and that suspended solids achieve 10 mg/l should be abandoned in favor of more realistic standards taking into account the capacity of receiving waters to assimilate wastewaters.

6. Pollution is inadequately monitored because the central and most regional environmental inspectorates have too few staff with the necessary skills, operate with inadequate or outdated laboratory facilities, and suffer from seriously inadequate transportation.

   Studies should be undertaken, in conjunction with those recommended in #3, to determine how best to strengthen pollution monitoring. Alternatives are to consolidate facilities and staff now located in various agencies, allocate complex sampling and testing to fewer regional centers or a central agency, and strengthen existing regional centers with funds from the higher level of fines recommended in #2.

7. Coordination among government water agencies is inadequate.

   As part of the study proposed in #3, recommendations should address improved coordination among the several agencies with water-related responsibilities. Among these should be a recommendation that agency reports be given wider distribution and also made available to the public.

8. Too little coordination takes place among riparian countries. While coordination between Moldova and Romania appears to be fairly good, it could be improved. Coordination between both countries and Ukraine is poor.

   Environmental agency heads in the three countries should designate senior representatives to serve on a joint committee to improve coordination. One objective to be considered is the establishment of a Prut River Basin Commission to facilitate uniform water-quality standards, data sharing, and cooperative programs to monitor pollution and to sample and test waters and wastewaters.

9. There is too little support for pollution cleanup. Without such support, it is hard to enforce environmental protection.

   The three governments should explore ways to provide positive support for pollution reduction, such as helping to plan lower cost facilities, allowing a reasonable time for polluters to meet treatment and effluent quality standards, and to the extent possible, providing some form of financial support or tax relief for the required facilities.

5.4 Data Management

Already, the three countries have achieved considerable computerization of their data. The data bases come from a variety of sources, and some of them are very large. Nevertheless, there is room for improvement; for example, some computers are underpowered for the demands and thus restrict access to data.

A data base management program is needed that will organize existing data from the three countries and incorporate that data not yet included in a common data base. In this study, the DEMDESS application program, based on the PARADOX data base manager, was used to

used to review and analyze selected data, and to produce the Prut River water-quality profiles shown in Figures 3 through 7.

Appendix A

PERSONS AND OFFICES CONTACTED

UKRAINE (Kiev)

USAID: 04/19/93
Mr. James Osborn, Project Officer
Mr. A.T. (Tony) Bilecky, Executive Officer

Ministry of Environmental Protection: 04/20/93
Mr. Yuri Ruban, First Deputy Minister, and Ukrainian Representative for the Danube Environmental Program
Mr. Sergey Bevz, Head Expert, Implementation International Programs

State Committee for Hydrometeorology (Hydromet): 04/20/93
(Reports to Ministry of Environmental Protection)
Mr. Alexander Kosovec, Director, National Center for Observation of the Environment

Ukrainian Scientific Center of Hygiene: 04/21/93
(Reports to Ministry of Health)
Dr. Andrey Serdyuk, Director, Hygiene Center

State Committee for Water Resources of Ukraine: 04/21/93
Mr. Ulian Bilotkach, Head, Department for Radiological and Hydrochemical Water Monitoring

USAID: 07/14/93
Mr. Norman Cohen
Mr. Richard Womack

Water Resources Management: 07/15/93
(Section of the Ministry of Environmental Protection)

Mr. Yevgeny Shchulypenko, Head of Water Resources Mgt. Section

Sanitary Inspection of Ukraine: 07/16/93
(Department of Ministry of Public Health)
Mr. Victor Marievsky, Head of Sanitary Inspection of Ukraine

UKRAINE (Chernivtsy)

Chernivtsy Regional Department of Ministry of Environmental Protection: 04/22/93, 04/23/93 & 05/03/93
Mr. Victor Motovilin, Director of Regional Office of MEP
Mr. Genadi Shnarevitch, Head of Analysis and Environmental Control
Mr. Fedir Klyanchuk, Head of Computer Department
Mr. Vitaly Korzhyk, Environmental Information Specialist and International Relations
Ms. Anna Belous, Head of Environmental Inspectorate
(Name not obtained), Head of Laboratory

Chernivtsy Wastewater Treatment Plant: 04/23/93
(Reports to Ministry of Community Services and the Mayor of the City of Chernivtsy)
Guide: Mr. Vitaly Korzhyk, Regional DEP office

Treatment Plant for Luzhansk Alcohol & Spirits Manufacturing Co: 04/23/93
Guide: Mr. Vitaly Korzhyk, Regional DEP office

Regional Office of Hygiene and Epidemiology: 04/22/93
(Reports to Ministry of Health)
(Name not obtained)

Regional Office of Hydromet: 04/22/93
(Reports to Ministry of Environmental Protection)
(Name not obtained)

Tour of Prut River Basin from Chernivtsy to Chisinau: 04/24/93
Overland trip through towns and villages in the Basin by part of WASH team on the Ukrainian and Moldovan side of the Prut River.

MOLDOVA (Chisinau)

US Embassy:
Ms. Mary Pendleton, Ambassador, 07/21/93
Ms. Susan Sutton, Second Secretary, 04/20/93 (tel call), 07/21/93
Mr. Richard Womack, USAID Officer, 07/21/93

US Peace Corps of Moldava: 04/23-04, 04/27/93
Ms. Maryann Murray, Director

State Department for Protection of the Environment and Natural Resources: 04/22/93, 04/27/93, 04/28/93 and 07/19/93

Office of the Chairman: 04/22/93, 07/19/93
Dr. Ion Dediu, Chairman
Dr. Arcadie Capcelea, First Vice Chairman
Mr. George Sprincheanu, Vice Chairman
Ms. Margareta Petrusevschi, Adviser to Chairman, Soil Scientist

State Ecological Inspectorate: 04/23/93, 04/27/93
Mr. Ion Stoleru, Head, Ecological Inspectorate
Mr. Dumitru Chiriac, Chief, Water Inspectorate

Mr. Viaceslau Grisenco, Chief, Pestocide Inspectorate

Science Directorate and Ecologic Monitoring: (04/28/93
Dr. Petru Kokyrtsa, Head, Science Directorate and Ecological Monitoring

Center for Hygiene and Epidemiology: 04/23/93
(Reports to the Ministry of Health)
Mr. Dumitru Sireteanu, Director
Mr. Ion Shalaru

Television Station "TV Moldova": 04/24/93
Interview of WASH team as part of Moldovan holiday to encourage respect for the environment.

MOLDOVA (Chisinau, continued)

Water Consortium Aqua: 04/27/93
(Reports to Ministry of Agriculture)
Mr. Vasili Grec, President
Mr. Nicolai Panov, Chief Engineer, Water Resources Management
Mr. Oleg Kozlenko, Head, Computer Section

State Committee for Hydrometeorology (Hydromet): 04/27/93
(Reports to Department for Protection of the Environment)
Mrs. Ludmila Kunicean, Head, Water Quality Survey Laboratory
Mrs. Ana Gomain, Senior Researcher

Polytechnical Institute of Chisinau: 04/27/93
Prof. Dimitri Ungureanu, Head, Department of Water Supply and Wastewater Treatment

Ministry of Community Services and Utilization of Housing Fund:
Mr. Mihai St. Severovan, Minister 04/28/93
Mr. Nikolai Panuli, Deputy Minister

Ministry of Agriculture: 04/28/93
Mr. Nicolai Paholco, Head, Waste Section
Mr. Karamfi, Waste Specialist

Chisinau Water and Wastewater Treatment Plants: 04/28/93
(Reports to Ministry for Community Services and Mayor)
Mr. Ivan Zhunya (Ion Junea), Chief Engineer

State Association for Geological and Topographical Surveys (AGeoM): 04/28/93
Mr. Yuri Ilyinsky, Deputy General Director and Head Geologist

Tour of Prut River Basin from Chisinau to Ungheni: 04/29/93
Overland trip through towns and villages in the Basin by WASH team on the Moldovan side of the Prut River.

MOLDOVA (Ungheni)

Ungheni Regional Ecological Inspectorate: 04/29/93
(Reports to State Department for Protection of the Environment and Natural resources)
Mr. Ion Panciuc, Head
Mr. Rogajanu Pavel, Chief of Water Resources and Air Quality

Ungheni Wastewater Treatment Plant: 04/29/93
(Reports to Ministry of Community Services and Mayor of City of Ungheni)
WWTP Operator

Ungheni City Hall: 04/29/93
Mr. Vasile Para, Mayor
Ms. Nina Tsetnarski, Advisor

Tour of Prut River Basin from Ungheni to Iasi: 04/29/93
Overland trip through towns and villages in the Basin by WASH team on the Moldovan side of the Prut River.

ROMANIA (Iasi)

Iasi Water and Wastewater Utility (RAJAC): 04/30/93
(Reports to Ministry of Community Services and the Mayor of Iashi)
Mr. Mihai Casparovici, Director General
Mr. Meglei Ionel-Vasile, Chief Engineer
Mr. Vasluianu Petre, Technical Director

Iasi Department of the Agency for Protection of the Environment: 04/30/93
(Reports to Agency for the Protection of the Environment)
Mr. Dionisie Simionescu, Director of Iasi APE and President of the Romanian-Moldovan Joint Prut River Commission
Mr. Trofin Vasile, Environmental Protection Inspector

ROMANIA (Iasi, continued)

Apele Romane: 04/30/93
(Reports to Ministry of Agriculture. This agency is similar to the Water Commission Aqua in Moldova)
Mr. Sbiera Ion-Bogdan, Director of Apele Romane in Iasi

Iasi Wastewater Treatment Plant: 04/30/93
Guide: Messrs. Casparovici and Ionel-Vasile of RAJAC

Wastewater Treatment Plant for the Tomesti Pig Farm: 04/30/93
Guide: Messrs. Casparovici and Ionel-Vasile of RAJAC

Tour of Prut River Basin from Iasi to Chernivitsy: 05/01/93
Overland trip through towns and villages in the Basin by WASH team on the Romanian side of the Prut River.

Brussels, Belgium

Danube Program Coordination Unit: 07/22/93
Mr. David Rodda, Team Leader of PCU
Mr. Kees Wijnen, Institutional Development Manager of PCU
Mr. Alan Tetlow, Water Chemist, Consultant to PCU
Mr. James Taft, USAID/Europe and EPA, Water Quality Specialist

Appendix B

DESCRIPTION OF DOCUMENTS AND DATA COLLECTED

GENERAL

The following is a list and brief description of documents and data collected during the course of this study. Each document or set of documents is given an identification number starting with a letter designating the country of origin (U, M, or R). The same numbers are marked on the original document for identification. Area maps that have their own identification numbers are referenced by their numbers. All these documents were boxed and delivered to the World Environment Center.

U.S. SOURCE

Water Pollution Issues in Moldova, Ukraine, Belarus and Russia, by Peggy Walker. WASH Working Paper No. 108. March 1993.

UKRAINE

U1. Prut River Basin, Preliminary Background and Contact Information. FYI Information Sources, April 1993. Prepared for WASH. Includes background, list of government contacts, industrial/agricultural enterprises, and non-profit or social organizations.

U2. Seven page table dated May 7, 1992, summarizing 1991 water use and emissions for the Chernovitsy Oblast. In Cyrillic.

U3. From Chernovitsy Health Department. In Cyrillic. The following:

List of pesticides monitored in drinking water

Two tables summarizing radioactivity in food

Table of statistics on birth defects

Three tables of data related to air quality

U4. From Chernovitsy Regional Department of Environmental Protection, Computer Department. In Cyrillic. The following:

Prut and Tributaries Schematic

U5. 1992 water quality analysis data from Hydromet. 18 pages. In Cyrillic.

U6. 1990 water quality analysis data obtained in Kiev on 7/15/93. 10 pages. In Cyrillic.

U7. Tables of allowable pollutant levels and corresponding levies. Eight pages. InCyrillic.

U8. The Ukraine 1991 Environmental Law. In Cyrillic.

U9. Regulations on penalties. Kiev 1992. 28 pages in Cyrillic.

U10. Water user/discharge reporting form. In Cyrillic.

MOLDOVA

M1. Prut River Basin, Preliminary Background and Contact Information. FYI Information Sources, April 1993. Prepared for WASH. Includes background, list of government contacts, industrial/agricultural enterprises, and non-profit or social organizations.

M2. Chart of annual use of pesticides in Moldova. In Romanian.

M3. Map of pesticide use in agriculture, 1992. In Romanian.

M4. Table of unused pesticide stocks. In Romanian.

M5. Table of structure of the Ministry of Communities. In Romanian.

M6. Table of present tariffs, 1992. In Cyrillic.

M7. Table of hydraulic data, 1991. Three pages in Cyrillic.

M8. Table of in-stream water quality, 1991. Seven pages in Cyrillic. Also diskette containing same data with text and "Supercalc" files.

M9. Table of municipal wastewater treatment plant effluent data, 1992. Hydromet. Three pages in Romanian.

M10. "STUDY/PROGRAM Concerning Water Quality Protection and Rational Use of Water in the Prut River Basin. Permanent Moldova/Romania Ecological Joint Commission." Preliminary Copy 1993. 27 pages including annexes in Romanian.

M11. Table of animal farm size and emission, 1993. Four handwritten pages in Romanian.

M12. A conceptual scheme for ecological monitoring. One page in Romanian.

M13. Map of Prut River water intakes with list of users. In Cyrillic.

M14. Water user/discharge reporting forms. In Romanian and Cyrillic.

M15. Application forms to extract water and discharge wastewater. In Romanian.

M16. 1986 Water Use Book. 124 pages. In Cyrillic.

M17. 1977 to 1987 annual water quality data (streams). 15 pages of handwritten tables. In Cyrillic.

M18. Article by Ion Dediu on toxic substances in the Prut. Seven pages. In Romanian.

M19. Moldova "Water Code." 56 pages in Romanian.

M20. Moldova "Underground Resources Code." 31 pages. In Romanian.

M21. Moldova "Environmental Protection Law" (passed June 1993). 53 pages. In Romanian.

M22. Moldova 1991 Statistical Book (Economy). 406 pages. In Romanian and Cyrillic.

M23. Environmental articles (technical papers). 285 pages. In Cyrillic.

M24. (Proceedings of the) XVIII Congress of the Romanian-American Academy of Sciences and Arts, 1993. Volume 3. In Romanian and English.

M25. Article on surface waters, 1992. 47 pages. In Cyrillic.

M26. Environmental articles, 1992. 236 pages. In Romanian.

M27. 1992 Prut River water quality profiles. 12 graphs. (same data as from the Romanian sources. See below.)

ROMANIA

R1. Map of Romanian side of the Prut basin showing river sampling points and summary analysis results, 1991.

R2. Table of Romanian/Moldovian Prut joint sampling stations, 1993.

R3. Table of hydrometric data, 1992. Seven pages.

R4. Graphs showing concentration of pollutants in the Prut, 1992. Seven graphs.

R5. Water quality profiles. One page.

R6. Iasi Municipal Wastewater Treatment Plant influent data.

R7. Tables of in-stream water quality data, 1992. 13 pages.

R8. Graphs of pollutant levels in the Prut, 1991. Eight graphs on two pages.

R9. Prut River and tributaries (Romanian side only).

R10. Hydrological data on the Prut and the tributaries (Romanian side only).

R11. "Supra92" Romanian Water Quality Database, 1992. For the Prut and its tributaries in Romania. Diskette plus data dump (hard copy) by WASH in three sets designated R11a, R11b, and R11c.

R12. "Rom92" Romanian Water Quality Database, 1992. For the Prut sampling stations and including samples taken by Moldova. Diskette plus data dump (hard copy) by WASH in two sets designated R12a and R12b (six pages each).

R13. A handwritten summary "Potential Problems on the Romanian Border of the Prut River" by WASH consultant Alexander Ionescu, July 19, 1993. In English.

R14. Exchange of faxes between Don Cullivan and Alex Ionescu dated July 1993, providing additional information.

MAPS

U-map 1.	Chernovitsy Oblast, Ukraine. 1:200,000. In Cyrillic.
U-map 2.	Map of Ukraine. 1:2,000,000. In English.
M-map 1.	Map of Moldova. 1:500,000. In Romanian.
TPC F-3B	Tactical Pilotage Chart. Covers lower Prut basin. 1:500,000.
TPC F-3A	Tactical Pilotage Chart. Covers short segment of the Prut north of Iasi. 1:500,000.
TPC E-3C	Tactical Pilotage Chart. Covers segment of the Prut in the Chernivitsy region. 1:500,000.
ONC E-3	Operational Navigation Chart. Covers the Prut from Chernivitsy area to the source. 1:1,000,000.

CONTACTS

See envelope marked "copies of business cards."