DANUBE POLLUTION REDUCTION PROGRAMME

NATIONAL REVIEWS 1998
SLOVENIA

TECHNICAL REPORTS

Part C: Water Quality

Part D: Water Environmental Engineering

MINISTRY OF ENVIRONMENT AND PHYSICAL PLANNING

in cooperation with the

Programme Coordination Unit
UNDP/GEF Assistance

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Preface

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

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

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

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

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

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

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

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

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

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

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

The **Slovenian National Reviews** were prepared under the supervision of the Country Programme Coordinator, **Mr. Mitja Bricelj**. The authors of the respective parts of the report are:

- Part A: Social and Economic Analysis: **Mr. Marjan Ravbar**
- Part B: Financing Mechanisms: **Mr. Janez Kimovec**
- Part C: Water Quality: **Mr. Boris Kompare**
- Part D: Water Environmental Engineering: **Mr. Uros Kranjc**

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Part C

Water Quality

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List of Abbreviations
on Water Quality

A	anum, year
AC	Activated Carbon
AEWS	Accident Emergency Warning System
AOX	Absorbable (on AC) Organic Halogenated compounds
BAT	Best Available Technologies
BATNEEC	Best Available Technologies Not Entailing Excessive Costs
BAP	Best Agricultural Practice
BEP	Best Environmental Practice
BOD	Biochemical Oxygen Demand
BOD_5	Biological Oxygen Demand in 5 days
Bq	becquerel
cap	capita
CBO	Citizen Based Organization
CEE	Central and Eastern Europe
CEEC	Central and Eastern European Countries
CEFTA	Central European Free Trade Agreement
CFC	Chlorofluorocarbon
CITES	Convention on International Trade in Endangered Species of Wild Flora and fauna
COD	Chemical Oxygen Demand
CPC	Country Program Coordinator
CPI	Consumer Price Index
CSO	Combined Sewer Overflow
CVAAS	Cold Vapor Atomic Absorption Spectrometry
DANIS	Danube Information System
DBAM	Danube Basin Alarm Model
DDT	Dichlorodipheniltrichloroethane, insecticide
DEA	Metabolite of pesticide Atrazine (Triazine)
DEF	Danube Environmental Forum
DEM	Deutsche Mark = German Mark
DG	Directorate General of the European Commission
DIA	Metabolite of pesticide Atrazine (Triazine)
DIN	Deutsche Industry Norm = German Industry Norm

DISAE	Development of Implementation Strategies for Approximation in Environment
DMSG	Data Management Sub-Group
DRBPRP	Danube River Basin Pollution Reduction Program
DRPC	Danube River Protection Convention (= Convention for the Protection and Sustainable Use of the Danube River Basin)
DWQM	Danube Water Quality Model
EAP	Environmental Action Plan
EBRD	European Bank for Reconstruction and Development
EC	European Community
ECE	UN Economic Commission for Europe
ECU	European Currency Unit = XEU
EEC	European Economic Community
EECONET	European Ecological Network
EFTA	European Free Trade Association
EIA	Environmental Impact Assessment
EIB	European Investment Bank
EMAS	European Management and Audit Scheme
EMEP	Cooperative program for Monitoring and Evaluation of the long-range transmission of air Pollutants in Europe
EMIS	Emission group
EOX	Extractable Organic Halogenated compounds
EPA	Environmental Protection Act for Slovenia, 1993
EPA	Environmental Protection Agency
EPDRB	Environmental Program for the Danube River Basin
EPR	Environmental Performance Review for Slovenia, 1997
ETAAS	Extraction (Graphite) Tube Atomic Absorption Spectrometry
EU	European Union
EU EPA	European Union Environmental Protection Agency
FAAS	Flame Atomic Absorption Spectrometry
FDI	Foreign Direct Investment
FGD	Flue-Gas Desulphurization
FPSG	Financing Partners Sub-Group
g	gram = 0.001 kg
g/l	grams per liter
G-24	the Group of 24 industrialized nations (members of the OECD)

GC/MS	Gas Chromatography and Mass Spectrometry
GDP	Gross Domestic Product
GEF	Global Environmental Facility
GEF-DRBPRP	GEF - Danube River Basin Pollution Reduction Program
GEMS	Global Environmental Monitoring System
GIS	Geographical Information System
GJ	gigajoule = 10^9 J
GNP	Gross National Product
GW	Ground-Water
h	hour
ha	hectare = 10,000 m^2 = 0.01 km^2
HCH	Hexachlorocyclohexane = g-HCH=Lindane (insecticide)
HEPP	Hydro-Electric Power-Plant
HMI	Hydrometeorological Institute of Slovenia
HP	Heating Plant
HS	Hot Spot
IBA	Important Bird Areas
IBRD	International Bank for Reconstruction and Development (The World Bank)
IC	International Commission of the DRPC
IEA	International Energy Agency
IFI	International Financial Institution(s)
inh.	inhabitants
kinh	kilo inhabitants = 1000 inh. = 1k inh.
IPCC	International Panel on Climate Change
IPPC	Integrated Pollution Prevention and Control
ISO	International Organization for Standardization
IUCN	International Union for the Conservation of Nature and Natural Resources (= World conservation union)
J	joule
kg	kilogram = 1000 g
km	kilometer = 1000 m
km^2	square kilometer
kW	kilowatt = 1000 W
kWh	kilowatt hour
l	liter = 0.001 m^3

LPG	Liquefied Petroleum Gas
LU	Livestock Unit = equivalent to 500 kg live weight
m	meter
m^2	square meter
m^3	cubic meter
m^3/s	cubic meters per second
MAC	Maximal Allowable Concentration
MAP	Mediterranean Action Plan
MARPOL	International Convention for the Prevention of Pollution from Ships (=Marine Pollution)
MCPP	Acryloxy alcanic acid (herbicide)
MECU	Millions of ECU
MEPP	Ministry of Environment and Physical Planning (of Slovenia)
MoEPP	Ministry of Environment and Physical Planning (of Slovenia)
mg	milligram
µg	microgram = 10^{-6} g
mg/l	milligrams per liter
min	minute = 1/60 hour
ml	milliliter = 0.001 l
MLIM	Monitoring, Laboratory and Information Management sub-group
MPN	Most Probable Number of bacteria in a 100 ml sample
MW	megawatt = 10^6 W
MWh	megawatt hour
N/A	Not Available
NAP	National Action Plan
NEAP	National Environmental Action Plan
ng	nanogram = 10^{-9} g
NGO	Non-governmental Organization
NMVOC	Non-Methane Volatile Organic Compound
NPEP	National Plan of Environmental Protection = NEAP
NPP	Nuclear Power-Plant
NRP	National Research Program
OECD	Organization for Economic Co-operation and Development
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyl(s)

PCDD	(Polychlorinated Dibenzo) Dioxin
PCU	(Danube) Program Coordination Unit
PE	Population equivalent
pH	negative log10 of concentration of H^+ (measure of acidity)
PHARE	EU program of assistance for economic restructuring in CEEC
PIAC	Principal International Alert Centers
PJ	petajoule = 10^{15} J
PPC	Project Preparation Committee of the Environmental Action Prog
REC	Regional Environmental Center for Central and Eastern Europe
RSE	Report on the State of the Environment (Slovenia)
s	second = 1/60 min = 1/3600 h
SANC	State Authority for Nature Conservation (within MoEPP)
SAP	Strategic Action Plan (for the Danube River basin)
SIT	Slovenian national currency Tolar
SITC	Standard International Trade Classification
SME	Small- and medium-size enterprise(s)
t	metric ton = 1000 kg
TACIS	EU program of Transfer of know-how to the New Independent States and Mongolia
TAIEX	EU program of Technical Assistance Information Exchange Office of the European Commission
TNMN	Trans-National Monitoring Network
TOC	Total Organic Carbon
toe	ton oil equivalent
TOR	Terms of Reference
TPES	Total Primary Energy Supply
TPP	Thermal Power Plant
TW	TeraWatt = 10^{12} W
UAA	Unit of Agricultural Area
UN	United Nations
UNDP	UN Development Program
UNECE	UN Economic Commission for Europe
UNEP	UN Environmental Program
UNESCO	UN Educational, Scientific and Cultural Organization
UNIDO	UN Industrial Development Organization
UNOPS	UN Office of Project Services

US	United States (of America)
USA	United States of America
USD	United States (of America) Dollars
USAID	Agency for International Development
USEPA	US EPA
VAT	Value-Added Tax
VOC	Volatile Organic Compound
VOC	Volatile Organic Compound
WHO	World Health Organization
WMO	World Meteorological Organization
WTO	World Trade Organization
WW	Wastewater
WWF	World-Wide Fund (for Nature)
WWTP	Wastewater Treatment Plant
XEU	European Union Currency Unit = ECU
Y	year = a = anum

Glossary
on Water Quality

AC	Activated Carbon
AOX	Absorbable (on AC) Organic Halogenated compounds
BOD	Biological Oxygen Demand
BOD_5	Biological Oxygen Demand in 5 days
CFC	Chlorofluorocarbon
Cd	Cadmium
COD	Chemical Oxygen Demand (Dichromate)
COD(Cr)	Chemical Oxygen Demand (Dichromate)
COD(Mn)	Chemical Oxygen Demand (Permanganate)
CSO	Combined Sewer Overflow
Cu	Copper
CVAAS	Cold Vapor Atomic Absorption Spectrometry
DEA	Metabolite of pesticide Atrazine (Triazine)
DIA	Metabolite of pesticide Atrazine (Triazine)
DO	Dissolved Oxygen
EOX	Extractable Organic Halogenated compounds
ETAAS	Extraction (Graphite) Tube Atomic Absorption Spectrometry
FAAS	Flame Atomic Absorption Spectrometry
FGD	Flue-Gas Desulphurization
GC/MS	Gas Chromatography and Mass Spectrometry
HCH	Hexachlorocyclohexane = g-HCH=Lindane (insecticide)
Hg	Quicksilver
HS	Hot Spot
LPG	Liquefied Petroleum Gas
MAC	Maximal Allowable Concentration
MCPP	Acryloxy alcanic acid (herbicide)
MPN	Most Probable Number of bacteria in a 100 ml sample
N	Nitrogen
NH_3	Ammonium

NH_3-N	Ammonium Nitrogen
NH_4	Ammonia ion
NH_4-N	Ammonia Nitrogen
NMVOC	Non-Methane Volatile Organic Compound
NO_2	Nitrite ion
NO_2-N	Nitrite Nitrogen
NO_3	Nitrate ion
NO_3-N	Nitrate Nitrogen
NOx	Different forms of gaseous nitrogen oxides
Ntot	Total Nitrogen, expressed as N
P	Phosphorus
PAH	Polycyclic Aromatic Hydrocarbons
Pb	Lead
PCB	Polychlorinated Biphenyl(s)
PCDD	(Polychlorinated Dibenzo) Dioxin
PE	Population equivalent in terms of pollution load (60 g BOD_5/day)
pH	negative log10 of concentration of H^+ (measure of acidity)
PO_4	Orthophosphate
PO_4-P	Orthophosphate Phosphorus
Ptot	Total Phosphorus
TKN	Total Kjeldahl Nitrogen, expressed as N
TOC	Total Organic Carbon
VOC	Volatile Organic Compound
WHO	World Health Organization
WMO	World Meteorological Organization
WW	Wastewater
WWTP	Wastewater Treatment Plant

Glossary
on Measures and Units

a	anum, year
Bq	Becquerel
cap	capita
g	gram = 0.001 kg
GJ	gigajoule = 10^9 J
g/l	grams per liter
h	hour
ha	hectare = 10,000 m^2 = 0.01 km^2
inh.	inhabitants
J	joule
kg	kilogram = 1000 g
kinh	kilo inhabitants = 1000 inh. = 1k inh.
km	kilometer = 1000 m
km^2	square kilometer
kW	kilowatt = 1000 W
kWh	kilowatt hour
l	liter = 0.001 m^3
LU	Livestock Unit = 500 kg of live weight
m	meter
m^2	square meter
m^3	cubic meter
m^3/s	cubic meters per second
mg	milligram
□g	microgram = 10^{-6} g
mg/l	milligrams per liter
min	minute = 1/60 hour
ml	milliliter = 0.001 l
MW	megawatt = 10^6 W
MWh	megawatt hour

ng	nanogram = 10^{-9} g
PE	population equivalent (in terms of pollution = 60 g BOD_5/day/inh.)
PJ	petajoule = 10^{15} J
s	second = 1/60 min = 1/3600 h
t	metric ton = 1000 kg
toe	ton oil equivalent
TW	TeraWatt = 10^{12} W
y	year = a = anum

1. Summary

1.1. Updating, Evaluation and Ranking of Hot Spots

The updating, evaluation and ranking of hot spots was done according to several criteria and several approaches. We have followed previous national plans for environmental protection (NPEP's), the proposed new NPEP (which is acceptation phase), judged present trends and views to environmental pollution and its mitigation, checked solutions against EU Water Framework Directive, etc., and finally ranked the resulting hot spots according the cost-effectiveness and relevance from the international point of view (GEF incremental funding).

We have listed 16 municipal wastewater discharges in rivers or lakes which need secondary or even tertiary treatment and which we believe are suitable for EU funding. Additionally, 9 industrial wastewater treatment plants were identified (according the criteria of more than 2 t COD/day, or more than 1 t BOD_5/day (Kresnik, 1998). Toxic or other inappropriate waters for biological treatment have to be pre-treated at the site anyway (according to EU and Slovenian legislation), and are not eligible for GEF funding, anyway. Agricultural point sources can be regarded as industry, and these are mainly animal farms, of which we spotted 4 big pig farms for GEF funding (see the list in next Chapter). Besides point sources, agriculture is predominant diffuse polluter and responsible for nitrates and pesticides in groundwater which is used for drinking water. Roughly half of groundwater is not appropriate for direct use for drinking water due to diffuse pollution.

1.2. Updating, Analysis and Validation of Water Quality Data

Surface water quality is in general slowly improving. This is mostly due to restructuring of industry and not so much to real care for the environment, although several municipal WWTP's are under design and construction (complying with EU Urban Wastewater Treatment Directive). The contribution of nutrients to surface water is roughly 50:50 from municipalities and industry vs. agriculture and other diffuse sources (dispersed urbanization).

At present, in main streams BOD and DO are not any long the problem. More severe is acute (lakes) and latent (rivers) eutrophication, which dictates in a national scale that possibly all the country will be declared as a sensitive area due to eutrophication (regarding the final recipients, i.e. Black Sea and Adriatic Sea). Under the term acute eutrophication we mean eutrophication which is clearly seen, e.g. alga blooms; while with the term latent eutrophication we mean eutrophication which is not developed, but could, if one of the missing conditions is fulfilled, e.g. if river course is impounded, and alga get enough time to grow. From the other point of view, if drinking water supply is going to increase the use of surface water, eutrophication will be an issue, again.

Regarding bathing water we have not yet officially designated bathing areas. But according to tradition, there are some rivers, or river stretches, where hygienisation (disinfection) of WWTP's effluents will be needed, at least during bathing seasons.

More than water quality itself it is concerning the quality of sediments, which are moved, or washed during high flows, typically during flood events. In sediments, a lot of past pollution load is buried, and can be activated during sediment transport.

In the view of international, or transboundary water quality problems, we have identified several rivers, or their stretches, or wetlands, which shall attract most attention of public and experts. Border rivers (with Croatia), such as Sotla and Kolpa, are given highest priority.

2. Updating of Hot Spots

The hot spots priority list(s) was (were) compiled already many times. In 1980-s a lot of big polluters have ceased to operate due to economic recession and restructuring of production, along with change in political profile of the state. This has continued also in early 1990-s, after the separation of Slovenia from Yugoslavia in 1991 and adaptation of Slovenian industry to new market conditions (preorientation from Yugoslav and Eastern European markets to EU markets). As a consequence, surface water quality has in general ameliorated for one class (out of four) without having made big investments, or constructions of wastewater treatment plants (WWTP's).

At the other side, quality of groundwater is stagnating, or slowly degrading, indicating problems with diffuse sources pollution, unregulated dump sites (land-fills), industrial "backyard" storage, bad agricultural practice, low environmental awareness of common people, traffic, dispersed urbanization, etc.

A lot of potential hot spots (HS), or "time-bombs" still wait to be discovered - e.g. practically all landfills are a source of untreated (or not adequately treated) leachates, some of the landfills are in inundation areas, many are above aquifers which procure drinking water, they store also dangerous or toxic waste, etc.

2.1. General Approach and Methodology

The methodology is based on extensive search and evaluation of existing data, i.e. data hold at the Ministries, published data in various resources, but also checked by intensive interviews of the working group members with authors of the mentioned reports or owners of the data. The guidelines of GEF-DRBPRP were followed.

For the evaluation of the hot spots (HS) and their ranking, at first place the guidelines of GEF-DRBPRP were followed, where we first considered the severity of the transboundary effects, second the preparation phase of the mitigation project (e.g. no project, project, in construction, etc.), and only then the local pollution, or local benefit from mitigation. All HS’s, but especially industrial pollution was considered in terms of incremental costs, and in terms of the private vs. public money involved.

2.1.1. Evaluation of Existing Hot Spots

First list

The first elaboration of hot spots was done by Slovenian task force (1995) in "SAP for Danube Catchment 1995-2005, approved 28 October, 1994 at Bled (Slovenia) on a national scale and 6 December 1994 in Bucharest (Romania) by ministers on an international scale.

The identified hot spots were 13, as shown in the Table 2.1.1-1, of them 9 were ranked into 1st priority, and 4 into the 2nd priority. Majority of identified hot spots was municipal WWTP’s.

Table 2.1.1.-1 Priority hot spots as defined in SAP of 1994 (listed alphabetically)

Location	River	Type	Description	Costs(1)	Prior.
Celje	Savinja/ Sava	Municipal WWTP	80,000 PE	N/A	1
Krško	Sava	Municipal WWTP + paper mill ind.	250,000 PE	N/A	1
Laško	Savinja/ Sava	Municipal WWTP	70,000 PE combined with brewery WW	N/A	1
Ljubljana	Ljubljanica/ Sava	Municipal WWTP	720,000 PE	N/A	1
Ljutomer	Mura	Municipal WWTP	20,000 PE; 21% sewerage	N/A	2
Maribor	Drava	Municipal WWTP	360,000 PE; 156,000 inh.; 51% sewerage	37 MUSD	1
Maribor	Drava	municipal solid waste	landfill, 20 years @ 325,000	500 kUSD	1
Maribor, Ptuj, Ormož	Drava	municipal drinking water supply	N/A	N/A	2
Metava/ Maribor	Drava	dangerous substances	leachate control	N/A	2
Murska Sobota	Ledava/ Mura	Municipal WWTP	reconstruction to 100,000 PE, 64 000 inh; 22% sewerage	6 MUSD	1
Rače	Drava	old landfill	pesticides leaching	N/A	2
Rogaška Slatina	Sotla/ Sava	Municipal WWTP	20,000 PE, cross-border (Croatia); tourism, health-resort	N/A	1
Trbovlje	Sava	Municipal WWTP	30,000 PE	N/A	1

(1) Costs as listed in the SAP (1994)

Second list

In a few years after the compilation of the first list of hot spots, some major changes in industry have changed the priority list, too. In meantime, the harmonization with EU practice and legislation has thrown new light on the extent of the environmental problems. So, already in 1996 a new list was elaborated, reflecting more the international problems, or "incremental costs", and leaving national priorities to be dealt with national resources (e.g., taxation, ECO-Fund) as much as possible.

Twelve hot spots - projects have been identified as suitable for international demo projects and at the same time representing trans-boundary effects, which gave rise to claims for additional, i.e. "incremental costs". The later shall be covered through the GEF program. The full description of projects is given in Annex 2.1.1-1, here we list only main features in the Table 2.1.1-2. (source: Information/Report by M. Gorišek of 12.03.1998)

Table 2.1.1.-2 Priority hot spots as defined in Slovenian SIP of 1996 (listed by "umbrella", defined by PCU)

Code	River	Title	Costs in XEU(1)	Status
S1	Sava	Sava Catchment Management Plan	420,000	approved by PHARE; waiting PHARE funds; start possibly in 1999
S2	Sotla/Sava	Multi-purpose Management of the Sotla River	200,000	approved by PHARE; waiting PHARE funds; start possibly in 1999
S6	Sava	Moste Reservoir Restoration Project - Environmental Management Master Plan and Restoration Preliminary Design for the Moste Reservoir in the Upper Sava River Basin	1,000,000 10 M (2)	approved by PHARE; waiting PHARE funds; start possibly in 1999
D1	Drava	Cost-Effective Nature Management of the Drava River Basin	420,000	approved by PHARE; waiting PHARE funds; start possibly in 1999
D2	Drava + Mura	Conflict Resolution among Users with Competing Interests	195,000	approved by PHARE; TOR until end Sept. '98; start possibly in Nov. '98
D3	Mura	Management of Waste from Pig-Farms in Slovenia	220,000	ongoing; 11-14 May '98 national workshop
D4	Drava + Mura	Contaminated Sediments in Quarry Lakes	363,000	approved by PHARE; waiting PHARE funds; start possibly in 1999
D5	Drava + Mura	Encouraging Co-operation between Small Communities for Water Services	114,000	approved by PHARE; TOR until end Sept. '98; start possibly in Nov. '98
D6	Mura	Improvement of Biodiversity in a Regulated River	90,000	approved by PHARE; TOR until end May '98; start possibly in Sept. '98
D7	Mura	Ecologically Sustainable Manure Disposal and Smell Abatement for Pig-Farm Podgrad	1,100,000	linked to D3; ongoing; 11-14 May '98 national workshop
D8	Mura	Wetlands on the Mura River	377,500 + 377,500 (SI + A)	linked to D1, D6; TOR until end May '98; start possibly in Sept. '98
D9	Mura + Drava	Groundwater Protection Model for the Arable Regions	830.000	approved by PHARE; TOR until end Sept. '98; start possibly in Nov. '98

(1) project proposals (costs of preparation work only)
(2) EPR p. 60, total costs of the project

Third list

Third list of hot spots is in preparation, or shall be published by the time of acceptation of this report, within the elaboration of the National Program of Environmental Protection (NPEP). The final draft of this NPEP is at present given into discussion at the government level. By the time the NPEP gets its final shape, the draft version is shown here, and in the other reports of this NEAP (i.e., Parts A, B, C, and D).

The draft version, which was submitted to the government level, is significantly reduced version of the latest working draft version which was prepared at the ministerial level. Mostly, all the detailed information along with the background, interpretation, and discussion is omitted, so only general information with summarizing tables is included. This means, for instance, that instead of giving a precise list of priority hot spots for surface water protection, only a general note of approximate number of hot spots, appropriate WWTP's, and associated costs is given. Actually, we will discuss in detail the working draft (ministerial level) version of the NPEP in subsequent Chapters, although the official information is the more general one from the final draft (governmental level).

The only WWTP's specifically listed in the NPEP (and lying in the DRB) are: Ljubljana, Maribor, Celje, Trbovlje, and Velenje. Besides this, cca 15 WWTP's (only by number!) for settlements of 2000-10 000 PE are foreseen by the year 2003 in the NPEP. Additional 10 WWTP's (again only by number!) are foreseen by 2003 due to the bathing water criteria for the whole Slovenian territory, which practically means that about half could be expected in the DRB, while the other half will probably be located along Adriatic coast.

2.1.2. Deletion of Existing Hot Spots

The only hot spots (HS) deleted should be those where the pollution ceased due to closure of the polluting industry or due to construction of an appropriate WWTP. Regarding the listed HS in the Tables 2.1.1-1 and 2.1.1-2 there is no change among the polluters. But due to the scope of the PHARE and GEF funding we have deleted from these two lists the projects which are not fully eligible for such funding, i.e. all the projects regarding provision of good quality drinking water and projects which have only indirect influence on water quality of transboundary rivers. These projects are given in Tables 2.1.1-3 and 2.1.1-4:

Table 2.1.1.-3 Priority hot spots as defined in SAP of 1994 (listed alphabetically) in the Table 2.1.1-1 and not included in this NEAP

Location	River	Type	Description	Costs(1)	Prior.
Maribor	Drava	municipal solid waste	landfill, 20 years @ 325,000	500 kUSD	1
Maribor, Ptuj, Ormož	Drava	municipal drinking water supply	N/A	N/A	2
Metava/ Maribor	Drava	dangerous substances	leachate control	N/A	2
Rače	Drava	old landfill	pesticides leaching	N/A	2

(1) Costs as listed in the SAP (1994)

The projects deleted from the second list (which indeed includes only demo projects!) are those which are already funded from EU sources, e.g. PHARE/GEF, or projects which indeed do not represent a hot spot "per se", but mean a certain policy in the catchment. Namely, we were instructed during preparation of the list of hot spots, that the preference would be given to the "bankable" projects in front of the "organizational" projects. Similarly, wetlands will be dealt with in another, separated group, so we omitted wetlands, too. So, indeed, from this list only projects S2 (only municipal WWTP), D3 (pig farms Podgrad and Nemščak-Ižakovci) and D7 are retained, where D3 and D7 are considered as one project. The S6 project “Moste Reservoir Restoration Plan” is already running, while the D9 project “Groundwater Protection Model for the Arable Regions” is in the phase of international bid.

Table 2.1.1.-4 Priority hot spots as defined in Slovenian SIP of 1996, Table 2.1.1-2, (listed by "umbrella", defined by PCU), and not included in this NEAP

Code	River	Title	Costs in XEU(1)	Status
S1	Sava	Sava Catchment Management Plan	420,000	approved by PHARE; waiting PHARE funds; start possibly in 1999
S6	Sava	Moste Reservoir Restoration Project - Environmental Management Master Plan and Restoration Preliminary Design for the Moste Reservoir in the Upper Sava River Basin	1,000,000 10 M (2)	approved by PHARE; waiting PHARE funds; start possibly in 1999
D1	Drava	Cost-Effective Nature Management of the Drava River Basin	420,000	approved by PHARE; waiting PHARE funds; start possibly in 1999
D2	Drava + Mura	Conflict Resolution among Users with Competing Interests	195,000	approved by PHARE; TOR until end Sept. '98; start possibly in Nov. '98
D4	Drava + Mura	Contaminated Sediments in Quarry Lakes	363,000	approved by PHARE; waiting PHARE funds; start possibly in 1999
D5	Drava + Mura	Encouraging Co-operation between Small Communities for Water Services	114,000	approved by PHARE; TOR until end Sept. '98; start possibly in Nov. '98
D6	Mura	Improvement of Biodiversity in a Regulated River	90,000	approved by PHARE; TOR until end May '98; start possibly in Sept. '98
D8	Mura	Wetlands on the Mura River	377,500 + 377,500 (SI + A)	linked to D1, D6; TOR until end May '98; start possibly in Sept. '98
D9	Mura + Drava	Groundwater Protection Model for the Arable Regions	830.000	approved by PHARE; TOR until end Sept. '98; start possibly in Nov. '98

(1) project proposals (costs of preparation work only)
(2) EPR p. 60, total costs of the project

2.1.3. Addition of Hot Spots

The hot spots which we added are mainly those, which are the main polluters from the national point of view, but are lying on the main streams or their immediate tributaries, and thus significantly contribute to the transboundary pollution, in first place to downstream Croatia. Some bigger polluters, which will have to construct 3rd stage of WWTP's due to local (national) interests, are not included in this NEAP priority HS's list due to the propositions of the GEF funding (only HS's with transboundary effects, which will not (need not) be tackled at the national level). So the included HS's are given in next Table 2.1.1-5:

Table 2.1.1.-5 Added hot spots

Municipal WWTP's

No.	Wastewater Treatment Plant
1	Wastewater Treatment Plant Lendava
2	Wastewater Treatment Plant Sevnica
3	Wastewater Treatment Plant Brežice
4	Wastewater Treatment Plant Črnomelj (3rd phase)
5	Wastewater Treatment Plant Metlika
6	Wastewater Treatment Plant Novo Mesto
7	Wastewater Treatment Plant Vrhnika
8	Wastewater Treatment Plant Velenje (added from NPEP)

Agricultural (farms) WWTP's

No.	Wastewater Treatment Plant
1	Farma Ihan / Farm Ihan
2	Farma Jezera - Rakičan / Farm Jezera - Rakičan

Industrial WWTP's

No.	Wastewater Treatment Plant
1	Pivovarna Union Ljubljana Brewery Union Ljubljana
2	Tovarna papirja Paloma Pulp and paper plant Paloma
3	Industrija usnja Vrhnika Leather Industry Vrhnika
4	Ljubljanske mlekarne Dairy Factory Ljubljana
5	Radeče papir Paper industry Radeče
6	Pomurka Murska Sobota Food industry Pomurka Murska Sobota
7	Mariborske mlekarne Dairy Factory Maribor

2.1.4. Ranking of Hot Spots

In principle, all here listed hot spots are ranked as the first priority, i.e. they must be constructed in the shortest possible time (e.g. in next 5 years to the end of 2003). Regarding the EU Urban Wastewater Treatment Directive some of this should happen already in 1998, or in next two years until the end of 2000.

Table 2.1.1.-6 Priority list of ranked hot spots

Municipal WWTP's

Rank	Wastewater Treatment Plant	Priority
1	Wastewater Treatment Plant Maribor (3rd phase))	High
2	Wastewater Treatment Plant Ljubljana (3rd phase)	High
3	Wastewater Treatment Plant Murska Sobota (3rd phase)	High
4	Wastewater Treatment Plant Celje (3rd phase)	High
5	Wastewater Treatment Plant Rogaška Slatina	High
6	Wastewater Treatment Plant Lendava	High
7	Wastewater Treatment Plant Ljutomer	High
8	Wastewater Treatment Plant Krško	Medium
9	Wastewater Treatment Plant Brežice	Medium
10	Wastewater Treatment Plant Črnomelj (3rd phase)	Medium
11	Wastewater Treatment Plant Metlika	Medium
12	Wastewater Treatment Plant Novo Mesto	Low
13	Wastewater Treatment Plant Velenje (added from NPEP)	Low
14	Wastewater Treatment Plant Sevnica	Low
15	Wastewater Treatment Plant Vrhnika	Low
16	Wastewater Treatment Plant Trbovlje (added from NPEP)	Low

Agricultural (farms) WWTP's

Rank	Wastewater Treatment Plant	Priority
1	Farma Ihan / Farm Ihan	High
2	Farma Podgrad / Farm Podgrad	High
3	Farma Nemščak – Ižakovci / Farm Nemščak - Ižakovci	high
4	Farma Jezera - Rakičan / Farm Jezera - Rakičan	high

Industrial WWTP's

Rank	Wastewater Treatment Plant	Priority
1	Industrija usnja Vrhnika / Leather Industry Vrhnika	high
2	Tovarna papirja ICEC Krško / Paper Factory ICEC Krško	high
3	Pomurka Murska Sobota / Food industry Pomurka Murska Sobota	high
4	Tovarna papirja Paloma / Pulp and paper plant Paloma	high
5	Pivovarna Laško / Brewery Laško	medium
6	Radeče papir / Paper Radeče	medium
7	Mariborske mlekarne / Dairy Factory Maribor	low
8	Ljubljanske mlekarne / Dairy Factory Ljubljana	low
9	Pivovarna Union Ljubljana / Brewery Union Ljubljana	low

As Slovenia is in the phase of harmonizing its legislation with the one of the EU, we expect some derogation could be negotiated, e.g. construction of listed WWTP's is finished by the end of 2005, or even later – at the pace that the national economy can allow.

In practice, we have ranked all the listed HS's according to the severity of the problem (in the transboundary sense) and the stage of the project preparation (i.e. ready projects first). The resulted ranked list is given in the Table 2.1.1-6.

2.1.5. Map of Hot Spots

For the map of hot spots please see Fig. 2.1.5-1 on the next page. For a list of existing and planned municipal WWTP's on a short term, please see the Fig. 2.1.5-2, on the following pages.

For the "identity card" of the listed hot spots please see the findings in Krajnc & Žaja (1998), Part C: Water engineering, (still in preparation, thus tables in the Annex 2.2-1 Summary of Information for the Hot Spots could not have been completed), and accompanying data of monitoring in Annex 2.2-2 Monitoring of Critical Emissions of Hot Spots. In the latter table some data for some hot spots are missing – this is due to the fact that the monitoring program does not comprise such hot spots (e.g. outlets of municipal sewerage into a watercourse without any treatment).

FIG.: 2.1.1.5-1
LIST OF HOT SPOTS WITH
SURFACE WATER QUALITY FOR THE YEAR 1995
- SAPROBIOLOGICAL ANALYSES

Fig.: 2.1.5-2


MUNICIPAL WWTP's
AUSTRIA
HUNGARY
ITALY
CROATIA
MURA catchment
DRAVA catchment
SAVA catchment
SOČA catchment
OBALA catchment
Adriatic Sea
LEGEND:
Capacity of WWTP
E unit (population equivalent)
< 2.000
>= 2.000 < 10.000
>= 10.000 < 100.000
>= 100.000
Stage
pretreatment
mechanically
biologically
watershed
new investments in year 1995 and after
0 5 10 20 30 40 km
approx 1:1 000 000
REPORT ON THE STATE OF THE ENVIRONMENT 96' - URSVN, Ljubljana

2.2. Municipal Hot Spots

2.2.1. High Priority

Hot Spot #1:	WWTP Maribor (3rd phase)
(a) Emissions (today):	110 000 PE of inh. and 50 000 PE ind., 300 000 PE 2nd stage biol. WWTP in construction
(b) Seasonal Variations:	small
(c) Immediate Causes of Emiss.:	nonexisting nutrient removal and disinfection
(d) Root Causes of Water Quality Problems:	BOD, COD, sanitary pollution
(e) Receiving Waters:	Drava
(f) Nearby Downstream Uses:	Ptuj lake - recreation
(g) Transboundary Implications:	eutrophication of HEPP impoundment in Croatia

Hot Spot #2:	WWTP Ljubljana (3rd phase)
(a) Emissions (today):	275 000 PE of inh. And 110 000 PE ind. 500 000 PE 1st stage mech. WWTP in function, will be upgraded to 2nd stage shortly
(b) Seasonal Variations:	small
© Immediate Causes of Emiss.:	nonexistent nutrient removal and disinfection
(d) Root Causes of Water Quality Problems:	BOD, COD, sanitary pollution
(e) Receiving Waters:	Ljubljanica, Sava
(f) Nearby Downstream Uses:	Ljubljanica as a water course in urban area
(g) Transboundary Implications:	eutrophication of HEPP impoundment in Croatia

Hot Spot #3:	WWTP Murska Sobota (3rd phase)
(a) Emissions (today):	16 000 PE of inh. and 35 000 PE ind. 20 000 PE 2nd stage biol. WWTP in operation, upgrade to 60 000 PE 2nd stage in near future
(b) Seasonal Variations:	relatively small
(c) Immediate Causes of Emiss.:	nonexistent nutrient removal and disinfection
(d) Root Causes of Water Quality Problems:	BOD, COD, sanitary pollution
(e) Receiving Waters:	Ledava, Mura
(f) Nearby Downstream Uses:	Ledava as a water course in densely populated area
(g) Transboundary Implications:	eutrophication of river Mura in Croatia

Hot Spot #4:	WWTP Celje (3rd phase)
(a) Emissions (today):	45 000 PE of inh. and 12 000 PE ind. planned 90 000 PE 2nd stage biol. WWTP
(b) Seasonal Variations:	small
(c) Immediate Causes of Emiss.:	nonexistent WWTP, nutrient removal and disinfection
(d) Root Causes of Water Quality Problems:	BOD, COD, sanitary pollution
(e) Receiving Waters:	Savinja, Sava
(f) Nearby Downstream Uses:	Savinja as a water course in urban area, bathing
(g) Transboundary Implications:	eutrophication of Sava in Croatia, water supply (Zagreb)

Hot Spot #5:	WWTP Rogaška Slatina
(a) Emissions (today):	6 000 PE of inh. and 3 000 PE ind. + tourism planned 12 000 PE 3rd stage biol. WWTP
(b) Seasonal Variations:	relatively small
(c) Immediate Causes of Emiss.:	nonexistent water treatment, nutrient removal and disinfection
(d) Root Causes of Water Quality Problems:	BOD, COD, sanitary pollution
(e) Receiving Waters:	Sotla, Vonarsko lake, Sava
(f) Nearby Downstream Uses:	Vonarsko lake, bathing
(g) Transboundary Implications:	eutrophication of Vonarsko lake, and Sava in Croatia, water supply (Zagreb)

Hot Spot #6:	WWTP Lendava
(a) Emissions (today):	3 600 PE of inh. and 13 000 PE ind. planned 22 000 PE 3rd stage biol. WWTP
(b) Seasonal Variations:	small
(c) Immediate Causes of Emiss.:	nonexistent water treatment, nutrient removal and disinfection
(d) Root Causes of Water Quality Problems:	BOD, COD, sanitary pollution
(e) Receiving Waters:	Ledava, Mura
(f) Nearby Downstream Uses:	Ledava as a water course in densely populated area
(g) Transboundary Implications:	eutrophication of Mura river in Croatia

Hot Spot #7:	WWTP Ljutomer
(a) Emissions (today):	3 600 PE of inh. and 8 000 PE ind., planned 15 000 PE 2nd stage in near future
(b) Seasonal Variations:	small
(c) Immediate Causes of Emiss.:	nonexistent water treatment, nutrient removal and disinfection
(d) Root Causes of Water Quality Problems:	BOD, COD, sanitary pollution
(e) Receiving Waters:	Ščavnica, Mura
(f) Nearby Downstream Uses:	Ščavnica as a water course in densely populated area
(g) Transboundary Implications:	eutrophication of Mura river in Croatia

2.2.2. Medium Priority

Hot Spot #8:	WWTP Krško
(a) Emissions (today):	8 000 PE of inh. and 1 000 PE ind., planned 15 000 PE 2nd stage biol. WWTP
(b) Seasonal Variations:	Small
(c) Immediate Causes of Emiss.:	nonexistent water treatment, nutrient removal and disinfection
(d) Root Causes of Water Quality Problems:	BOD, COD, sanitary pollution
(e) Receiving Waters:	Sava
(f) Nearby Downstream Uses:	Sava as bathing and recreational water
(g) Transboundary Implications:	eutrophication of Sava river in Croatia, water supply (Zagreb), bathing and recreational water (Zagreb)

Hot Spot #9:	WWTP Brežice
(a) Emissions (today):	7 000 PE of inh. and 2 000 PE ind. + tourism, planned 10 000 PE 2nd stage biol. WWTP
(b) Seasonal Variations:	Notable
(c) Immediate Causes of Emiss.:	nonexistent water treatment, nutrient removal and disinfection
(d) Root Causes of Water Quality Problems:	BOD, COD, sanitary pollution
(e) Receiving Waters:	Sava
(f) Nearby Downstream Uses:	Sava as bathing and recreational water
(g) Transboundary Implications:	eutrophication of Sava river in Croatia, water supply (Zagreb), bathing and recreational water (Zagreb)

Hot Spot #10:	WWTP Črnomelj (3rd phase)
(a) Emissions (today):	6 000 PE of inh. and 500 PE ind., planned 10 000 PE 2nd stage
(b) Seasonal Variations:	small
(c) Immediate Causes of Emiss.:	nonexistent nutrient removal and disinfection
(d) Root Causes of Water Quality Problems:	BOD, COD, sanitary pollution
(e) Receiving Waters:	Kolpa, Sava
(f) Nearby Downstream Uses:	Kolpa and Sava as bathing and recreational water
(g) Transboundary Implications:	eutrophication of Kolpa and Sava river in Croatia, water supply (Zagreb), bathing and recreational water (Zagreb)

Hot Spot #11:	WWTP Metlika (3rd phase)
(a) Emissions (today):	500 PE of inh. and 500 PE ind., planned 5 500 PE 2nd stage biol. WWTP
(b) Seasonal Variations:	small
(c) Immediate Causes of Emiss.:	nonexistent nutrient removal and disinfection
(d) Root Causes of Water Quality Problems:	BOD, COD, sanitary pollution
(e) Receiving Waters:	Kolpa, Sava
(f) Nearby Downstream Uses:	Kolpa and Sava as bathing and recreational water
(g) Transboundary Implications:	eutrophication of Kolpa and Sava river in Croatia, water supply (Zagreb), bathing and recreational water (Zagreb)

2.2.3. Low Priority

Hot Spot #12:	WWTP Novo Mesto
(a) Emissions (today):	23 000 PE of inh. and 9 000 PE ind., planned 45 000 PE 2nd stage biol. WWTP
(b) Seasonal Variations:	small
(c) Immediate Causes of Emiss.:	nonexistent nutrient removal and disinfection
(d) Root Causes of Water Quality Problems:	BOD, COD, sanitary pollution
(e) Receiving Waters:	Krka, Sava
(f) Nearby Downstream Uses:	Krka and Sava as bathing and recreational water
(g) Transboundary Implications:	eutrophication of Sava river in Croatia, water supply (Zagreb), bathing and recreational water (Zagreb)

Hot Spot #13:	WWTP Velenje
(a) Emissions (today):	30 000 PE of inh. And 3 000 PE ind., planned 50 000 PE 2nd stage biol. WWTP
(b) Seasonal Variations:	small
© Immediate Causes of Emiss.:	nonexistent nutrient removal and disinfection
(d) Root Causes of Water Quality Problems:	BOD, COD, sanitary pollution
(e) Receiving Waters:	Savinja, Sava
(f) Nearby Downstream Uses:	Savinja and Sava as bathing and recreational water
(g) Transboundary Implications:	eutrophication of Sava river in Croatia, water supply (Zagreb), bathing and recreational water (Zagreb)

Hot Spot #14:	WWTP Sevnica
(a) Emissions (today):	5 000 PE of inh. and 3 000 PE ind., planned 12 000 PE 2nd stage biol. WWTP
(b) Seasonal Variations:	small
(c) Immediate Causes of Emiss.:	nonexistent water treatment, nutrient removal and disinfection
(d) Root Causes of Water Quality Problems:	BOD, COD, sanitary pollution
(e) Receiving Waters:	Sava
(f) Nearby Downstream Uses:	Sava as bathing and recreational water
(g) Transboundary Implications:	eutrophication of Sava river in Croatia, water supply (Zagreb), bathing and recreational water (Zagreb)

Hot Spot #15:	WWTP Vrhnika
(a) Emissions (today):	7 000 PE of inh. and 32 000 PE ind., planned 45 000 PE 2nd stage biol. WWTP
(b) Seasonal Variations:	small
(c) Immediate Causes of Emiss.:	Non-appropriate water treatment, nutrient removal and disinfection
(d) Root Causes of Water Quality Problems:	BOD, COD, sanitary pollution
(e) Receiving Waters:	Ljubljanica, Sava
(f) Nearby Downstream Uses:	Ljubljanica as river in proposed protected area, as river in urbanized area, as bathing and recreational water
(g) Transboundary Implications:	eutrophication of Sava river in Croatia, water supply (Zagreb), bathing and recreational water (Zagreb)

Hot Spot #16:	WWTP Trbovlje
(a) Emissions (today):	17 000 PE of inh. and 2 500 PE ind., planned 30 000 PE 2nd stage biol. WWTP
(b) Seasonal Variations:	small
(c) Immediate Causes of Emiss.:	nonexistent water treatment, nutrient removal and disinfection
(d) Root Causes of Water Quality Problems:	BOD, COD, sanitary pollution
(e) Receiving Waters:	Sava
(f) Nearby Downstream Uses:	Sava as recreational water, HEPP
(g) Transboundary Implications:	eutrophication of Sava river in Croatia, water supply (Zagreb), bathing and recreational water (Zagreb)

2.3 Agricultural Hot Spots

2.3.1. High Priority

Hot Spot #1:	Pig farm Ihan
(a) Emissions (today):	1 000 PE of inh. and cca 110 000 PE agric. + ind.
(b) Seasonal Variations:	small
(c) Immediate Causes of Emiss.:	Ind. WWTP yielding 11 000 PE at output, but nonexistent nutrient removal and disinfection
(d) Root Causes of Water Quality Problems:	BOD, COD, sanitary pollution
(e) Receiving Waters:	Kamniška Bistrica, Sava
(f) Nearby Downstream Uses:	Kamniška Bistrica as bathing and recreational water in densely populated area, Sava as recreational water
(g) Transboundary Implications:	eutrophication of Sava river in Croatia, water supply (Zagreb), bathing and recreational water (Zagreb)

Hot Spot #2:	Pig farm Podgrad
(a) Emissions (today):	200 PE of inh. and cca 40 000 PE agric. + ind.
(b) Seasonal Variations:	small
(c) Immediate Causes of Emiss.:	bad maintenance of well designed WWTP with insufficient nutrient removal (only N) and lack of disinfection
(d) Root Causes of Water Quality Problems:	BOD, COD, sanitary pollution
(e) Receiving Waters:	Mura
(f) Nearby Downstream Uses:	spa Radkesburg in Austria (bad smell), Mura as recreational water and water in protected area (wetlands)
(g) Transboundary Implications:	eutrophication of Mura river in Croatia

Hot Spot #3:	Pig farm Nemščak
(a) Emissions (today):	200 PE of inh. and cca 55 000 PE agric. + ind.
(b) Seasonal Variations:	small
(c) Immediate Causes of Emiss.:	bad maintenance of WWTP, lack of nutrient removal and lack of disinfection
(d) Root Causes of Water Quality Problems:	BOD, COD, sanitary pollution
(e) Receiving Waters:	Mura
(f) Nearby Downstream Uses:	Mura as recreational water and water in protected area (wetlands), infiltrates groundwater
(g) Transboundary Implications:	eutrophication of Mura river in Croatia

Hot Spot #4:	Pig farm Rakičan
(a) Emissions (today):	200 PE of inh. and cca 55 000 PE agric. + ind.
(b) Seasonal Variations:	small
(c) Immediate Causes of Emiss.:	bad maintenance of WWTP, lack of nutrient removal and lack of disinfection
(d) Root Causes of Water Quality Problems:	BOD, COD, sanitary pollution
(e) Receiving Waters:	Mura
(f) Nearby Downstream Uses:	Mura as recreational water and water in protected area (wetlands), infiltrates groundwater
(g) Transboundary Implications:	eutrophication of Mura river in Croatia

2.3.2. Medium Priority

NONE

2.3.3. Low Priority

NONE

2.4. Industrial Hot Spots

2.4.1. High Priority

Hot Spot #1:	WWTP Leather Industry Vrhnika
(a) Emissions (today):	500 PE of inh. and 100 000 PE ind.
(b) Seasonal Variations:	small
(c) Immediate Causes of Emiss.:	bad performance of existing ind. WWTP, lack of toxicity removal (Cr^{6+})
(d) Root Causes of Water Quality Problems:	BOD, COD, sanitary pollution, toxic waste
(e) Receiving Waters:	Ljubljanica, Sava
(f) Nearby Downstream Uses:	Ljubljanica as bathing and recreational water, as water in proposed protected area (Ljubljana moor)
(g) Transboundary Implications:	eutrophication of Sava river in Croatia, water supply in Croatia (Zagreb)

Hot Spot #2:	WWTP Paper Factory ICEC Krško
(a) Emissions (today):	500 PE of inh. and 450 000 PE ind.
(b) Seasonal Variations:	small
(c) Immediate Causes of Emiss.:	insufficient performance of existing ind. WWTP, lack of removal of suspended solids, toxic matter (Cl)
(d) Root Causes of Water Quality Problems:	BOD, COD, sanitary pollution, toxic waste
(e) Receiving Waters:	Sava
(f) Nearby Downstream Uses:	NEPP Krško cooling system, Brežice bathing resort
(g) Transboundary Implications:	eutrophication of Sava river in Croatia, water supply in Croatia (Zagreb)

Hot Spot #3:	WWTP Food Industry Pomurka Murska Sobota
(a) Emissions (today):	200 PE of inh. And cca 15 000 PE ind.
(b) Seasonal Variations:	small
© Immediate Causes of Emiss.:	connected to existing (overloaded) municipal WWTP
(d) Root Causes of Water Quality Problems:	BOD, COD, sanitary pollution
(e) Receiving Waters:	Ledava, Mura
(f) Nearby Downstream Uses:	Ledava as recreational water, and water in densely populated area, Mura with wetlands
(g) Transboundary Implications:	eutrophication of Mura river in Croatia

Hot Spot #4:	WWTP Pulp and Paper Plant Paloma
(a) Emissions (today):	1 000 PE of inh. and cca 50 000 PE ind.
(b) Seasonal Variations:	small
(c) Immediate Causes of Emiss.:	lack of treatment
(d) Root Causes of Water Quality Problems:	BOD, COD, sanitary pollution, suspended solids
(e) Receiving Waters:	Mura
(f) Nearby Downstream Uses:	Mura with wetlands
(g) Transboundary Implications:	eutrophication/deterioration of Mura river in Croatia

2.4.2. Medium Priority

Hot Spot #5:	WWTP Brewery Laško
(a) Emissions (today):	500 PE of inh. and cca 35 000 PE ind.
(b) Seasonal Variations:	small
(c) Immediate Causes of Emiss.:	no WWTP
(d) Root Causes of Water Quality Problems:	BOD, COD, sanitary pollution
(e) Receiving Waters:	Savinja, Sava
(f) Nearby Downstream Uses:	Sava impounded for HEPP - eutrophication
(g) Transboundary Implications:	eutrophication of Sava river in Croatia, water supply in Croatia (Zagreb)

Hot Spot #6:	WWTP Paper Industry Radeče
(a) Emissions (today):	500 PE of inh. and 20 000 PE ind.
(b) Seasonal Variations:	small
(c) Immediate Causes of Emiss.:	no WWTP
(d) Root Causes of Water Quality Problems:	BOD, COD, sanitary pollution, suspended solids
(e) Receiving Waters:	Sava
(f) Nearby Downstream Uses:	Sava impounded for HEPP - eutrophication
(g) Transboundary Implications:	eutrophication of Sava river in Croatia, water supply in Croatia (Zagreb)

2.4.3. Low Priority

Hot Spot #7:	WWTP Dairy Factory Maribor
(a) Emissions (today):	500 PE of inh. and cca 35 000 PE ind.
(b) Seasonal Variations:	small
(c) Immediate Causes of Emiss.:	no WWTP, in future connected to municipal WWTP
(d) Root Causes of Water Quality Problems:	BOD, COD, sanitary pollution
(e) Receiving Waters:	Drava
(f) Nearby Downstream Uses:	Drava impounded for HEPP - eutrophication
(g) Transboundary Implications:	eutrophication of Drava river in Croatia

Hot Spot #8:	WWTP Dairy Factory Ljubljana
(a) Emissions (today):	500 PE of inh. and cca 30 000 PE ind.
(b) Seasonal Variations:	small
(c) Immediate Causes of Emiss.:	connected to municipal WWTP
(d) Root Causes of Water Quality Problems:	BOD, COD, sanitary pollution
(e) Receiving Waters:	Sava
(f) Nearby Downstream Uses:	Sava impounded for HEPP - eutrophication
(g) Transboundary Implications:	eutrophication of Sava river in Croatia, water supply in Croatia (Zagreb)

Hot Spot #9:	WWTP Brewery Union Ljubljana
(a) Emissions (today):	500 PE of inh. and cca 20 000 PE ind.
(b) Seasonal Variations:	small
(c) Immediate Causes of Emiss.:	connected to municipal WWTP
(d) Root Causes of Water Quality Problems:	BOD, COD, sanitary pollution
(e) Receiving Waters:	Sava
(f) Nearby Downstream Uses:	Sava impounded for HEPP - eutrophication
(g) Transboundary Implications:	eutrophication of Sava river in Croatia, water supply in Croatia (Zagreb)

3. Identification of Diffuse Sources of Agricultural Pollution

This section summarizes important diffuse (i.e. non-point) sources of pollution (i.e. polluters). Such sources are typically intensively used agricultural areas, e.g. fields (arable land), pastures, meadows, orchards, vineyards, etc. Agricultural point sources as e.g. farms, manure storage etc. are discussed in previous section 2.3.

Intensification of agricultural activities is expected in the future as Slovenia's national goal is to become self-sufficient in agricultural production. A national plan of irrigation is already accepted (10 000 ha), the total number of small individual farms of average 3.2 ha agricultural land (EPR, 1997, p.115) is decreasing in favor of increasing bigger individual farms. It is foreseen that around 70% of agricultural land will belong to farms of 15 ha and more. This will draw along also intensification of land use and intensification of agricultural activities. Unless an efficient farmers' advice service is advising farmers on "good, or best agricultural practice" (BAP) the farmers will use more fertilizers and pesticides as at present. The quantities of applied fertilizers and pesticides per hectare are now just around the recommended values by the EU doctrine of best agricultural practices (BAP). At present, the annual emerge input of fertilizers and other chemical compounds to agricultural land amounts to 35.6 kg/ha N, 20.9 kg/ha P (phosphates), 23.3 kg/ha K, 1.1 kg/ha pesticides, up to 5.4 t/ha of solid animal waste (manure) and 8 m^3/ha of slurry (EPR, 1997, p. 67).

Agriculture mainly pollutes with nutrients as N and P, pesticides, some metals (Zn (in food 500-1000 mg/kg), Cu (in food up to 100 mg/kg, fungicides), Cr (pesticides)), pathogens (bacteria and viruses), demands high BOD in water bodies, and seldom with other pollutants (spills of motor oils) (VGI, 1993b). Still, the impact of food additives to preserve health (antibiotics) and increase gain (growth promoters, enzymes) to the receiving water bodies and subsequent human digestion are still neither monitored, nor given enough concern. The main target water bodies is groundwater (GW), but these are connected with surface waters, so surface water is equally endangered. Still, due to higher flows, surface water is usually less polluted in terms of concentrations.

Surpassed maximal allowed concentrations (MAC) of nitrates, pesticides and metals are given in the figures on the following pages, i.e.,

- Fig. 3.1.: “Surpassed MAC values for nitrates in groundwater for the year 1995”
- Fig. 3.2.: “Surpassed MAC values for pesticides in groundwater for the year 1995”
- Fig. 3.3.: “Surpassed MAC values for heavy metals in groundwater for the year 1995”

Fig.: 3-1

Surpassed MAC values for nitrates in groundwater for the year 1995

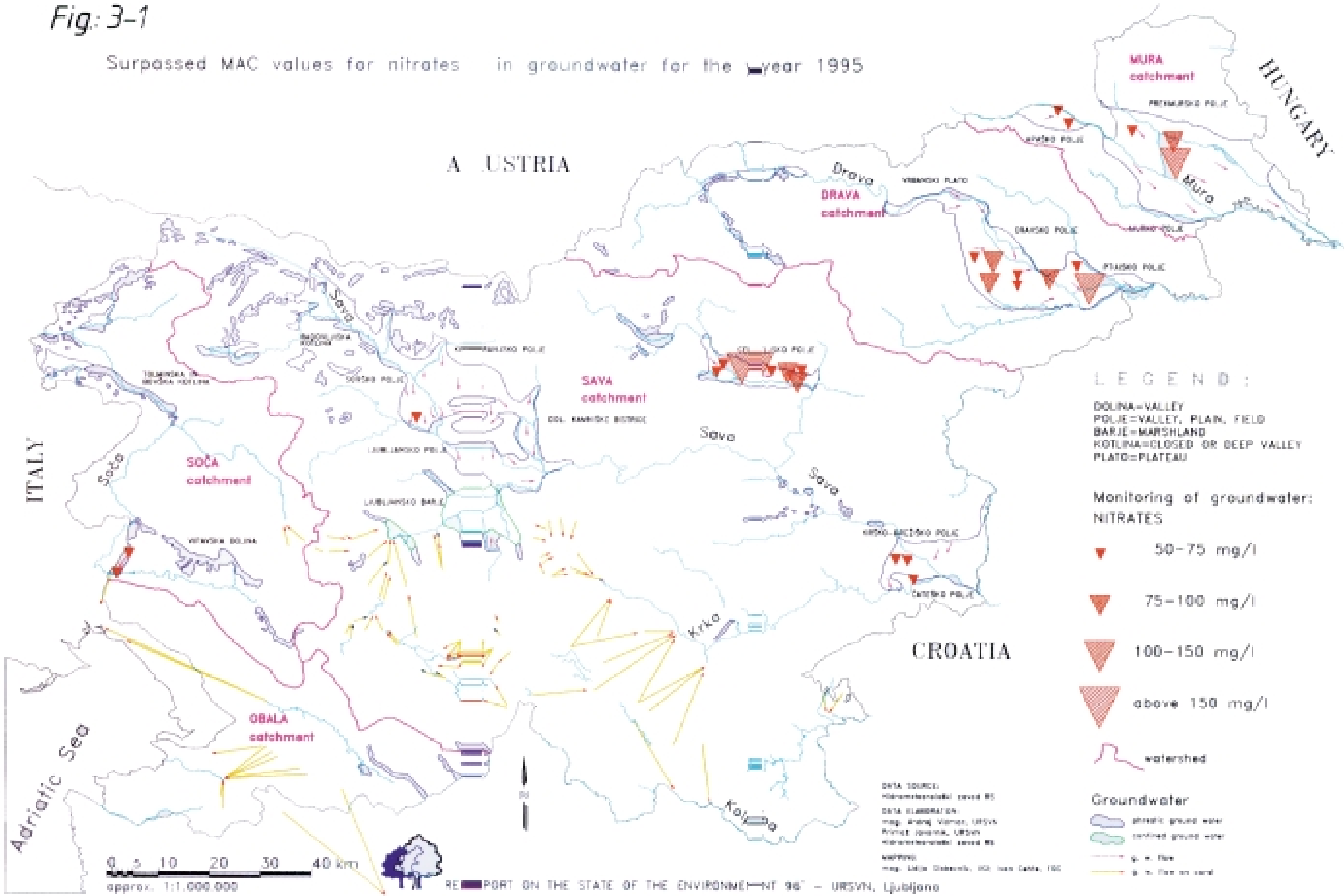


Fig: 3-2

Surpassed MAC values for pesticides in ground water for the year 1995

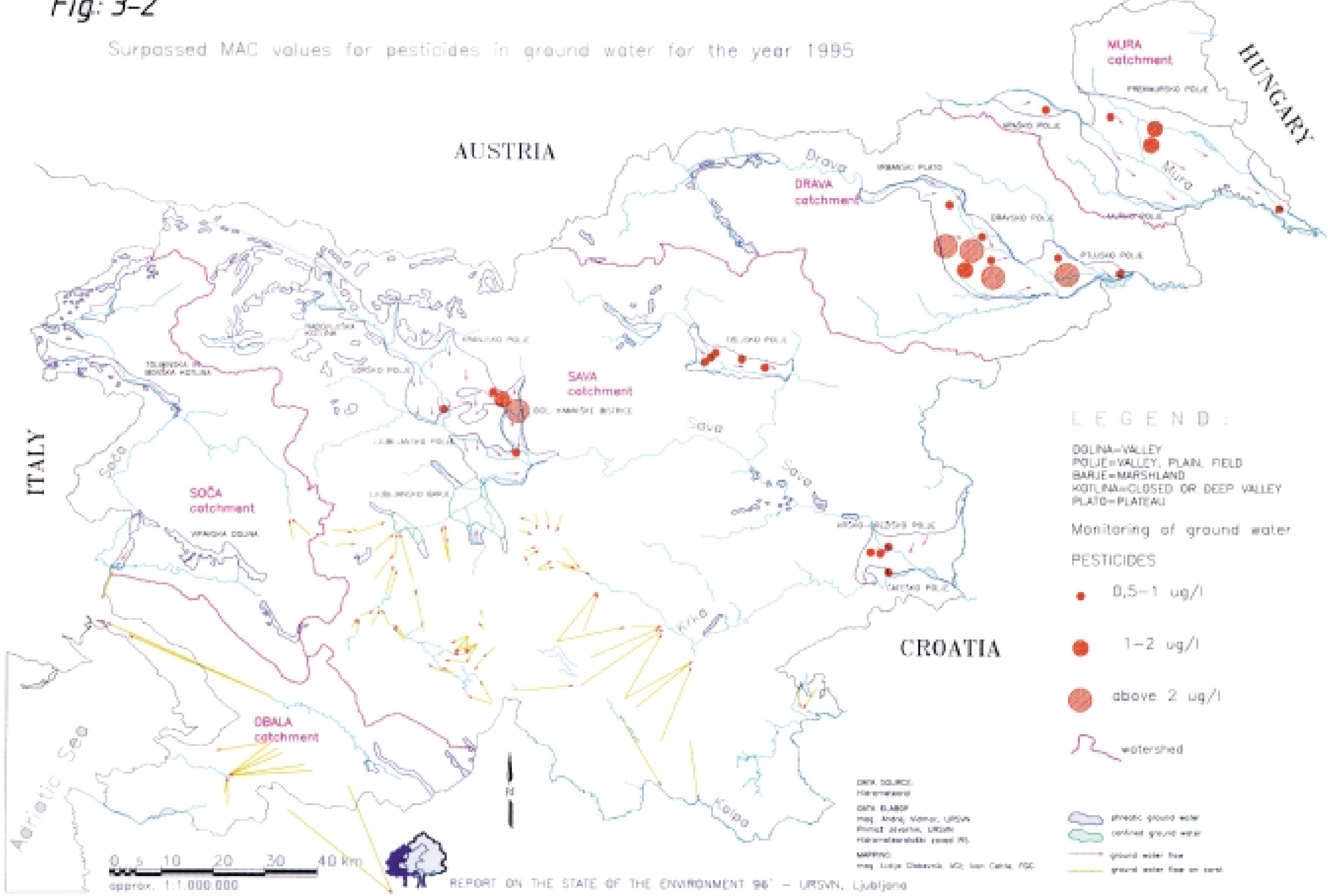
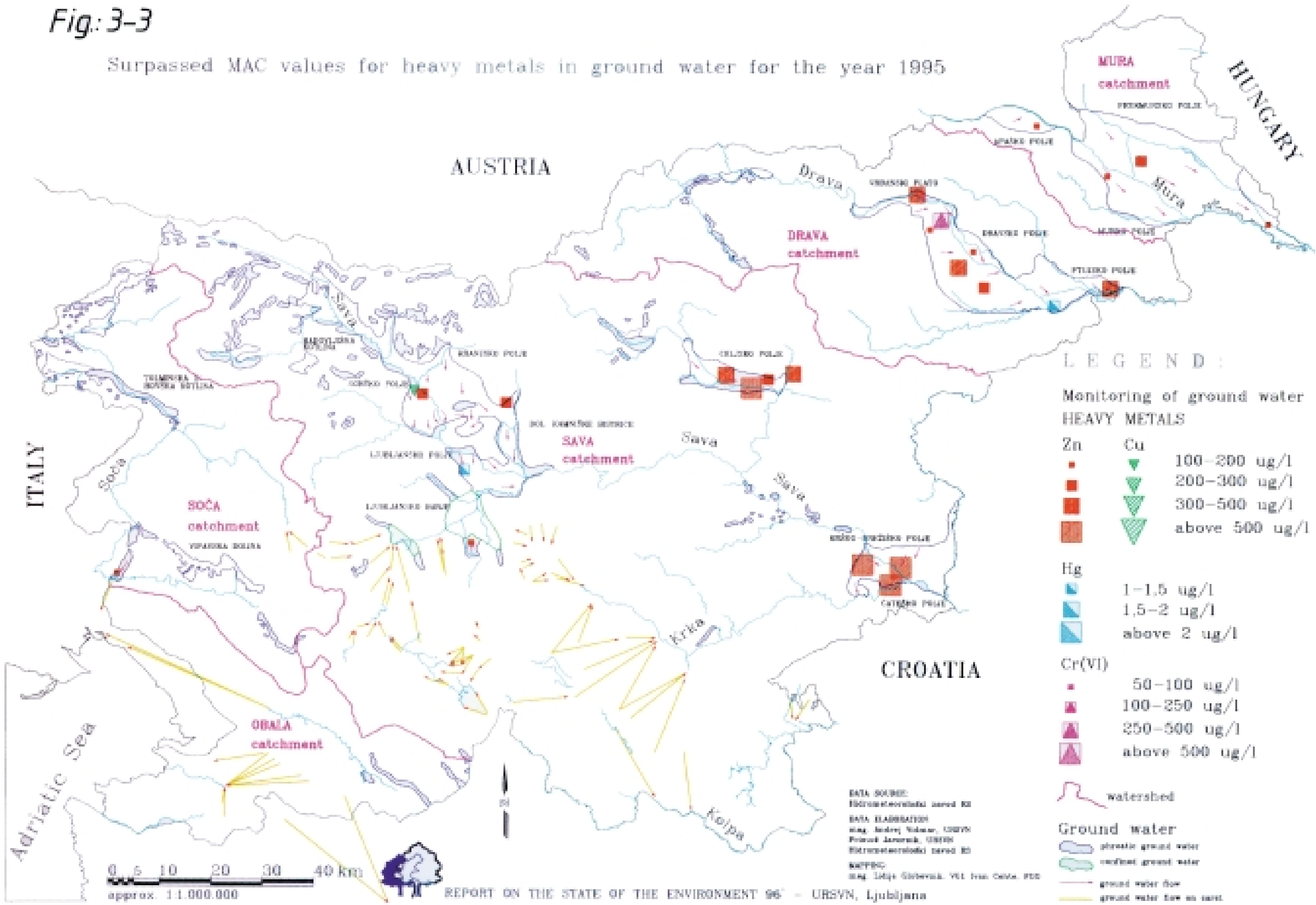


Fig.: 3–3


Surpassed MAC values for heavy metals in ground water for the year 1995
AUSTRIA
HUNGARY
ITALY
CROATIA
Adriatic Sea
MURA catchment
DRAVA catchment
SAVA catchment
SOČA catchment
OBALA catchment
Drava
Mura
Sava
Soča
Krka
Kolpa
LEGEND:
Monitoring of ground water
HEAVY METALS
Zn
Cu
100–200 ug/l
200–300 ug/l
300–500 ug/l
above 500 ug/l
Hg
1–1,5 ug/l
1,5–2 ug/l
above 2 ug/l
Cr(VI)
50–100 ug/l
100–250 ug/l
250–500 ug/l
above 500 ug/l
watershed
Ground water
0 5 10 20 30 40 km
approx. 1:1.000.000
REPORT ON THE STATE OF THE ENVIRONMENT 96' - URSVN, Ljubljana

Nitrates

European MAC for NO_3 in drinking water is 50 mg/l, recommended figure is 25 mg/l (see Council Directive 80/778/EEC). In Slovenia MAC for NO_3 is 44 mg/l (resulting from MAC for NO_3-N of 10 mg/l). The highest concentrations of nitrates in GW are on the fields: Prekmursko, Dravsko, and Ptujsko polje and Lower Savinjska valley. Increased levels of nitrates were detected on some places on Apaško, Sorško, and Krško polje and in Vipava valley (the latter is in the Adriatic Sea catchment). (HMI, 1996)

The concentrations of nitrates are shown in the following Table 3-1: Concentration of nitrates in groundwater across Slovenia in 1992, 1994 and 1995.

Table 3.1. Concentration of nitrates in groundwater across Slovenia in 1992, 1994 and 1995

LOCATION OF GROUNDWATER	NO. OF SAMPLING SITES	CONCENTRATION OF NITRATES					
		% SAMPLES ABOVE MAC* [%]			MAX VALUE DETECTED		
		1992	1994	1995	1992	1994	1995
Prekmursko - Apaško polje	7	43	64	64	127.1	169.6	100.1
Mursko polje	3	33	40	0	109.8	66.0	35.0
Dravsko polje - Vrbanski plato	10	59	55	59	86.4	90.8	83.3
Ptujsko polje	4	50	33	50	104.1	55.8	115.1
Sp. Savinjska dolina - dolina Bolske in Hudinje	11	82	76	60	130.6	97.4	112.9
Kranjsko polje	4	0	0	0	30.6	26.6	30.1
Sorško polje	9	17	11	17	73.5	58.5	68.2
Dolina Kamniške Bistrice - Vodiško polje	7	0	0	0	44.3	46.5	39.9
Ljubljansko polje in Barje	11	0	0	0	27.5	25.7	27.9
Brežiško - Čateško polje	5	0	0	0	11.1	35.4	25.4
Krško polje	8	7	47	40	57.1	60.7	64.2
Vipavsko - Soška dolina (Adriatic Sea)	4	50	38	25	81.9	106.7	68.0
SLOVENIA		34.3	32.5	29.9			

** Limit value for nitrates is 50 mg/l of NO_3 (EU), where 44 mg/l NO_3 correspond to 10 mg/l N (Slovenian legislation).*

Phosphates

Phosphate ion is not so mobile in the soil as the nitrogen ion and is therefore considered less important for GW pollution, especially from the standpoint of health implications. Still, phosphorus is usually the limiting nutrient in surface water and is thus directly responsible for eutrophication - in other words: eutrophication can be most efficiently (and economically) managed if concentrations of phosphorus are controlled. Thus, more important is concentration of phosphorus in surface water than in ground water, as the MAC for P_2O_5 in drinking water are much higher than concentrations which trigger hypereutrophication in stagnant surface water. It is worth noting that detergents, which are produced and/or sold in Slovenia, do not contain phosphates.

Pesticides

From the point of suitability of surface- and ground water for drinking and fish life, pesticides are among the most important pollutants in Slovenia. Within the monitoring of groundwater in Slovenia concentrations of 27 different pesticides and their metabolites that are (or were) sold in Slovenia are detected. The most common and usually forming the major part of the whole pesticides population in a water sample is Atrazine (derivative of Triazine), and its metabolites DEA and DIA. The use of Atrazine was destimulated in Slovenia years ago due to its toxicity and potential mutageneity, but it was not before the year 1996 that Atrazine was banned (decree in Official Gazette 68/96). Due to its environmental persistence it is still forming a major part of pesticides' pollution (and will probably still do for a number of years). Slovenian regulation on pesticides is old. It is important to notice that Slovenian regulations allow 2 μg/l of Atrazine, which is 20-times the MAC of EU. Still, HMI and other institutions which monitor drinking water, or judge on suitability of surface- or ground-water for drinking water, use the EU MAC of 0.1 μg/l of a single pesticide species, and 0.5 μg/l for all population of detected pesticides in the sample (HMI, 1997). The most common way in Slovenia is to detect the groundwater load with the sum of pesticides, which was in the year 1995 exceeded in 29 % of sampling sites.

The concentrations of pesticides are shown in the following Table 3-2: Concentration of pesticides in groundwater across Slovenia in 1992, 1994 and 1995. Similarly, the surpassed concentrations of pesticides and their metabolites in groundwater can be seen from the Fig. 3-2 in the inserted pages.

Other pollutants - Metals

Other pollutants that form disperse pollution from agriculture are mainly metals, organic growth stimulators (vitamins, enzymes) and drugs (antibiotics, hormones, etc.). Because the latter have still not got importance in the eyes of the responsible authorities, they are not monitored – so we will restrict ourselves to metals and leave out all other micropollutants.

The metals are usually part of mineral diet of animals, and are part of their food. This is particularly true for zinc Zn, which can be found in food in concentrations of 500-1000 mg/kg food, and for copper Cu, which can amount to 100 mg/kg food. From food stem also other metals, of which manganese Mn is obvious (part of green food), while other metals come into food during production in factories due to contact with machinery. For a typical manure from a farm, these concentrations can be expected in a ton of manure: Mn = 40 g/t, Cu = 3.5 g/t, Co = 0.2 g/t, Mo = 0.3 g/t, and Zn = 15 g/t (VGI, 1993b).

Other sources of metals are fertilizers and pesticides. Fertilizers imported from Austria contain up to 50 ppm of Cd.

Table 3.2. Concentration of pesticides in groundwater across Slovenia in 1992, 1994 and 1995

LOCATION OF GROUNDWATER	NO. OF SAMPLING SITES	SUM OF ALL PESTICIDES												CONC. OF ATRAZINE		
		SAMPLES WITHOUT PESTICIDES* [%]			SAMPLES UNDER MAC ** [%]			SAMPLES ABOVE MAC [%]			MAX DETECTED VALUE [µg/l]			MAX DETECTED VALUE* [µg/l]		
		1992	1994	1995	1992	1994	1995	1992	1994	1995	1992	1994	1995	1992	1994	1995
Prekmursko - Apaško polje	7	0	0	14	29	29	14	71	71	72	3.83	2.16	1.83	1.30	0.80	0.85
Mursko polje	3	0	0	67	67	83	33	33	17	0	0.55	0.59	0.34	0.20	0.25	0.12
Dravsko polje - Vrbanski plato	10	0	0	9	9	45	32	82	55	59	5.06	19.95	4.41	2.10	7.30	1.30
Ptujsko polje	4	0	0	0	25	63	25	75	37	75	2.17	1.44	2.34	1.10	0.49	0.82
Sp. Savinjska dolina - dolina Bolske in Hudinje	11	0	0	20	36	57	45	64	43	35	1.80	0.95	0.63	0.77	0.23	0.52
Kranjsko polje	4	14	0	25	57	100	75	29	0	0	0.73	0.27	0.14	0.40	0.15	0.13
Sorško polje	9	0	0	22	89	94	72	11	6	6	2.18	0.55	0.82	1.50	0.25	0.21
Dolina Kamniške Bistrice - Vodiško polje	7	0	0	0	58	50	50	42	50	50	4.66	3.17	2.70	0.82	0.56	0.47
Ljubljansko polje in Barje	11	10	0	14	90	95	86	0	5	0	0.27	0.61	0.33	-	0.57	0.32
Brežiško - Čateško polje	5	5	0	30	50	100	60	0	0	10	0.40	0.35	0.52	0.20	0.10	0.24
Krško polje	8	60	0	31	33	69	50	7	31	19	0.50	1.04	0.81	0.30	0.19	0.13
Vipavsko - Soška dolina	4	0	0	75	100	100	25	0	0	0	0.29	0.05	0.05	0.20	0	0
SLOVENIA								37.3	31.7	30.1						

* *under detection limit*
** *limit value for the sum of pesticides is 0.5 µg/l*
*** *limit value for atrazine is 0.1 µg/l*

3.1 Land Under Cultivation

In Slovenia, almost 40 % of the territory (862,430 ha) is agricultural land, of which 12.1% is arable land, and approx. 2/3 are natural grasslands (147,600 ha meadows, 353,600 ha pastures) (EPR, 1997, p. 82, 115). Around 90% of these area are in the Danube RB. One other source (VGI, 1993a) gives more detailed picture in Annex 7(a) on p. 66 as follows in the next table:

Table 3.1-1 Land use

Area/region	arable crop land	irrigated land	grassland, pasture	other agricultural uses
	% of area	% of area	% of area	% of area
Mura	39.72	0.3	2.63	23.6
Drava	16.35	0.2	6.93	18.5
Sava	12.82	0.08	11.6	16.8

Agriculture contributes around 50% to eutrophication with washout and percolation of nutrients into water bodies, and around 15% to pollution with toxic substances (pesticides, heavy metals) (EPR, 1997, p. 82).

Specific areas of intensive agricultural activities are practically all lowlands, where also main aquifers lie - so this is another point of great concern. Still, the more we go to the Eastern part of the country, the more lowland, and the more total area is devoted to agriculture, especially to arable land. The areas of intensive agriculture can be seen from the map of land use (see Part A (Ravbar et al.) of the integral report: Social and Economic Analysis ...).

The nitrogen balances can be seen from the Table 5.3 of EPR (1997, p.57), which is reproduced as our Table 3.1.-2 in the sequel, while fertilizer and pesticides balance is given in Table 3.1.-6 latter:

Table 3.1.-2 Regional nitrogen balances for 1991 in kg N/(ha.year)

REGION	Input atmosphere	Input mineral	Input liquid	Input Total	Nitrogen uptake	Net balance
Pomursko	17	64.7	122.4	187.1	86.5	100.6
Mariborsko	17	62.5	137.8	200.3	86.4	113.9
Koroško	17	44.9	100.7	145.7	69.7	76.0
Celjsko	17	56.0	103.1	159.1	83.4	75.7
Zasavsko	17	30.8	93.4	104.2	51.7	72.5
Posavsko	17	43.8	74.2	118.0	81.2	36.8
Dolenjsko	17	35.9	51.9	87.6	55.2	32.6
Širše Savsko	17	43.4	79.6	123.0	63.5	59.5
Zgornje Savsko	17	28.2	59.4	87.6	52.8	34.8
Notranjsko	17	20.9	54.2	75.1	42.8	32.2
Goriško	17	36.5	53.2	89.6	59.6	30.0
Obalno Kraško	17	30.6	38.0	68.6	49.6	19.0
SLOVENIA	17	47.2	89.8	137.0	70.8	66.2

Impact on surface- and ground water from applications of pesticides, chemical fertilizers and manure

The concentrations of pesticides, mainly Atrazine and its metabolites DEA and DIA in surface- and ground-water are given in the HMI (1997, p. 14) report in Table 4, which is reproduced here as Table 3.1.-3:

Table 3.1.-3 Atrazine, DEA and DIA in waters of Apaško polje (Mura), March 1993 - December 1994

SAMPLE	GROUNDWATER				SURFACE WATER			
	1993		1994		1993		1994	
	No.	%	No.	%	No.	%	No	%
	148	100	180	100	53	100	84	100
Atrazine								
≥ 0.1 μg/l	3	2	28	16	0	0	7	8
Max value [μg/l]	1.3		0.94		< 0.05		6.2	
DEA								
≥ 0.1 μg/l	1	1	58	32	0	0	10	12
Max value [μg/l]	0.1		0.98		< 0.05		2.1	
DIA								
≥ 0.1 μg/l	0	0	19	11	2	4	4	5
Max value [μg/l]	0.09		1.12		0.14		0.65	

It is indicative that the concentrations of Atrazine are exceeding MAC more frequently in wet periods (washout) than in dry periods, when higher concentrations could be intuitively expected due to lower flows. Typically, 2% of GW samples exceed MAC in dry periods, while 16% in wet periods. In surface water only during wet periods exceedeences are measured in 8% of samples (HMI, 1997, p 14). For the nitrates, the values are similar. It is also indicative that stronger rivers with higher flows are not so much polluted with nitrates and pesticides as the GW, which drains into them (an example Mura River and Apaško polje). This fact is mainly due to high flows which dilute the mass (concentration times flow) input from GW. It is estimated that in Slovenia we used in the year 1992 artificial fertilizers in order of 77 238 t of NPK, which means (by 20-30% of N) up to 23 795 t of N, and (by 14% of P) 10 790 t of P. The washout to the environment is estimated to 20% of N, i.e. 4 759 t N/year, and 10% of the applied P, i.e. 1 079 t P/year (VGI, 1993b).

Total agricultural production in the Danube Catchment Area

It is difficult to obtain reliable picture of total production, as a lot of farms are individual and rather small, on average only a few livestock units (LU) per individual farm. The production for bigger farms and with rather limited number of products can be partly assessed in annual statistical reports e.g. ZS (1996, 1997, and 1998). For the purpose of this report, the meat production is the one, which makes the most pollution. And among these industries, or agricultural activities, the pig farms bring the biggest part of all pollution in the terms of nutrients. Pig farms represent mostly point-source pollution, as the manure is usually not adequately treated and reused on the fields, and as the slurry usually flows poorly treated into the watercourses. Of course, the manure, or slurry which is applied on the fields, represents diffuse pollution. According to the study of Leskošek (1994) the capacities of pig farms are as given in the Table 3.1.-4, and if one calculates that one average farm pig (relatively small, i.e. 100 kg) pollutes as 2 inhabitants, we get for 230 000 pigs equivalent of 460 000 PE (population equivalents = persons).

Table 3.1.-4 Capacities of pig farms in Slovenia (Source: Leskošek, 1994)

FARM	CAPACITY (pigs in one moment)	RECEIVING STREAM	CATCHMENT
Ihan / Domžale	53 700	Kamniška Bistrica	Sava
Stična / Stična	12 000	Višnjica	Krka/Sava
Klinja vas / Kočevje	17 300	karstic stream	Krka/Sava
Pristava / Leskovec	15 000	Senuša	Krka/Sava
Draženci / Ptuj	40 500	Drava	Drava
Cven / Ljutomer	10 000	Murica / Ščavnica	Mura
Podgrad / G. Radgona	21 300	Mura	Mura
Nemščak / Ižakovci & Jezera / Rakičan	both together 56 300	Mura	Mura
TOGETHER	230 000 (cca)		

From the Danube Integrated Environmental Study, Phase I, Final Report for Slovenia (VGI, 1993b), we reproduce tables on p. 33 which summarize the number of animals and the manure produced. Roughly 90% of these numbers is in the DRB.

Table 3.1.-5 The number of animals and manure produced in Slovenia in 1991

type of animal husbandry	type of farms		nutrients in produced manure	
	household	big farms	t N/y	t P/y
Pigs	116 658	391 658	962	577
Cows	381 846	0	19 856	4 468
horses	10 312	0	804	161
chicken	1 419 884	1 349 264	1 569	646
sheep	22 972	0	239	30
total			23 430	5 882

Total amount of fertilizer and pesticide used

A trendline of total use of pesticides and fertilizers in Slovenia during 1980-1995 can be seen from Table 5 (HMI, 1997, p. 13), which is reproduced in the continuation:

Table 3.1.-6 Plant protection chemicals & fertilizers applied in 1980 - 1995

	1980	1985	1990	1991	1992	1993	1994	1995
MINERAL FERTILIZERS IN TOTAL [t]	137807	172267	149677	127111	113881	90473	182191	171389
Per ha cultivated land [kg]	214	267	229	196	175	139	290	270
Total N [kg]	22469	27882	27169	23758	21892	17473	33944	32508
Total P_2O_5 [kg]	13290	16016	14870	12702	10992	8810	18950	17851
PLANT PROTECTION CHEMICALS IN TOTAL [t]	2398	2368	2212	2030	1926	1672	1424	1495
Per ha cultivated land [kg]	3.72	3.66	3.39	3.12	2.97	2.58	2.23	2.36

Erosion and soil loss

Although Slovenia is among the most forested countries in Europe (53% of total area) and although roughly 60% of total area is natural or semi-natural, i.e. the land is not intensively cultivated or is managed in close-to-natural conditions, there are still large areas of slope and arable land erosion. EPR (1977, p. 79) estimates that 44% of the land is subject to erosion. In Vahtar & Kompare (1998) A. Horvat states that from this land 4 000 km^2 are the main source of erosion. In total, 1.5 M m^3/y of material is eroded into the main streams Sava, Drava and Soča (Adriatic Sea).

Most of the erosion occurs in the mountainous parts above the forest limit. Due to steep slopes, due to limestone and dolomite bedrock which are easily weathered, and due to relatively high annual precipitation and characteristic heavy rainstorms, the erosion induced by water is significant.

Another type of erosion on steep hills is due to change of land cultivation. Before, people were cultivating land mostly by hand and have developed efficient practices to reduce the erosion to minimal levels. Due to machine cultivation of land these conservation techniques can not be always met. E.g. on steep slopes machinery can not operate in the direction of the isohypse, but in the direction of the gradient, in order not to overturn. Such kind of cultivation inevitably induces favorable conditions for erosion. The other side of the same coin is that before people lived with the nature and developed very effective ways of erosion protection measures, while now these regions are depopulated of original inhabitants, instead, “tourists”, or “weekend dwellers” from the cities come to these regions, and these people are totally ignorant of the traditional way of living with the nature.

Erosion on lowlands is mainly due to washout during heavy rainstorms, where typical intensities are around 200 l/(s.ha) for a 15 min. rainstorm with a return period of one year.

In some parts of Slovenia, typically on Karst and in the Vipava valley, which lie in the Mediterranean part of the country, wind erosion in winter period is significant. This kind of erosion can be efficiently reduced with introduction of wind protection stripes of vegetation. Although this solution is known and accepted on different levels of state agencies and also by landowners, there is still very little done.

From the study of Nutrient Balances for Danube Countries (Consortium, 1997), Table 1-1 on p. 4 gives among other mayor features of individual countries also erosion rates for Slovenia, i.e. 6 kg N/(ha*y), and 0.1 kg P/(ha*y).

3.2. Grazing Areas

Grazing area (pastures) are estimated to amount to 353,600 ha (EPR, 1997, p. 115) for the whole Slovenia, of which around 80% can be contributed to the Danube RB.

The composition of land owners and land cultivators, according to present agricultural policy and economic strength of the country, is at present in favor of smaller farms, where a lot of farmers are half-time farmers, i.e. they have two jobs - in the morning at the office and in the afternoon in the fields. So there are not very many full-time farmers. The consequence is that the cows, cattle and pigs are not grazing outside, but are kept all day long in the stables. Mowing meadows and grassland, including former pastures provides food.

Total land used for grazing in Slovenia

Total land used for grazing in Slovenia which belongs to the Danube RB is around 163,429 ha (VGI, 1993a, p. 59-62). Of this number about 2/3 are owned by small farmers. About 8 900 horses, 500 000 cattle, and 21 000 sheep were reported in Slovenia for the year 1993, of which around 80% can be contributed to the DRB.

Specific areas of intense animal grazing land

Specific areas of intense animal grazing land are mainly pastures in high mountains over the forest limit, called in Slovenian language "planina". There is a trend to revive such planinas more from the point of view of cultural heritage than from the economical point of view. Still, with the trend of ecological farming such a trend will strengthen.

Such mountainous pastures are mainly in the Sava river catchment in the Alps (Pokljuka, Jelovica, Jezersko, Velika Planina), and in the hilly region of Kočevsko (again Sava River as the final receptor of environmental loads). But in the total, they represent today less than 1% of agricultural area, although in the past (see the map in Part A) they represented about 10%.

Sizes of pastures and estimated number of animals

The extent of pastures in use for intensive grazing is extremely low, less than 1% of the agricultural area (See the previous Chapter, and the Table 3.1-5) and the number of animals is negligible for the purpose of this study. Small ones with less than 20 cows do not use the pastures by big farmers, but mainly.

Impacts

The relative and absolute impact of these mountainous pastures to the water quality in the walleyes are not so much important in comparison with other pollution, mainly due to its prevailing extensive, and not intensive nature. Still, impact on local drinking water sources is considerable. A lot of water systems for villages and small communities have inadequate microbiological quality of drinking water, indicating pollution with manure. Nitrates can also exceed the MAC.

Locally, the impact of grazing and more intensive land use can cause problems of eutrophication of small water ponds, impoundment and above all, natural lakes.

4. Updating and Validation of Water Quality Data

4.1. Index of Water Quality Monitoring Records

The data in this chapter are mainly taken from the HMI (1998b) report: Surface Streams and Water Balance of Slovenia, and from the HMI (1998a) draft report: Report on the State of the Environment 1996 (Draft).

Although the TOR requires that the data be gathered and evaluated for the period 1994-1997, we could not follow it, as the official disclosure of measured data with their evaluation becomes available in 2-3 years. As seen from the HMI (1998a) report above, the data for 1996 are now under elaboration.

There were 163 operating water-level gauging stations in Slovenia in 1997 (roughly 80% of them are situated in the Danube River Basin), of which two are located at the lakes (Bled and Bohinj), and one is located at the sea (Adriatic/Mediterranean Basin). The average density of these gauging stations is one per 124 km^2 (the WMO guide 1 per 100-250 km^2). The water-level gauging stations are of three types, i.e. either water-level gauge (52 stations, or 27.3 %), or water level recorder (limnigraph, 124 stations, or 65.3 %), or automatic (14 stations, or 7.4 %). The data obtained from these three types can be categorized into four classes (A) water-level recorder of 30 or more years of continuous measurements, (B) water-level gauge (1 datum per day) of 30 or more years of continuous observations, (C) measured or observed data improved by or supplemented with correlation, and (D) incomplete string of data. A lot of stations have been abandoned (during some time twice as much stations were operating in Slovenia, i.e. 350).

It shall be noted that water-level gauging stations usually do not coincide with sampling points for water quality monitoring program. The exceptions are groundwater data, which are typically taken in wells, or boreholes. But for the purpose of water quality monitoring, HMI provides data of flow (discharge) from the nearest gauging station. A map Fig. 4.1-1 is included within this Chapter depicting all water-level gauging stations and next map on Fig. 4.1-2 all water-quality sampling stations in Slovenia.

There are 102 surface water quality-monitoring stations in Slovenia, among which roughly 80 % are in the Danube River basin. Usually, 4 measurements during the year are made. For the sake of getting the most representative chemical, biological, bacteriological, and saprobiological values, the sampling is typically done during low flows (prevailing conditions). Thus, the mass balance of pollutants, and especially sediment transport, which massively occur during high flows, are not measured and also can not be predicted. The measured values can give only the lower estimate for the mass balances. Still, there are two TNMN (Trans National Monitoring Network) stations situated on border with Croatia on Sava (No. 3860), and Drava (No. 2200) Rivers with monthly water quality monitoring of basic physical, chemical and bacteriological parameters and some analyses of saprobiology, metals, sediment, organic compounds and mineral oils.

Fig.: 4.1-1

THE GAUGING STATION NETWORK (1997)

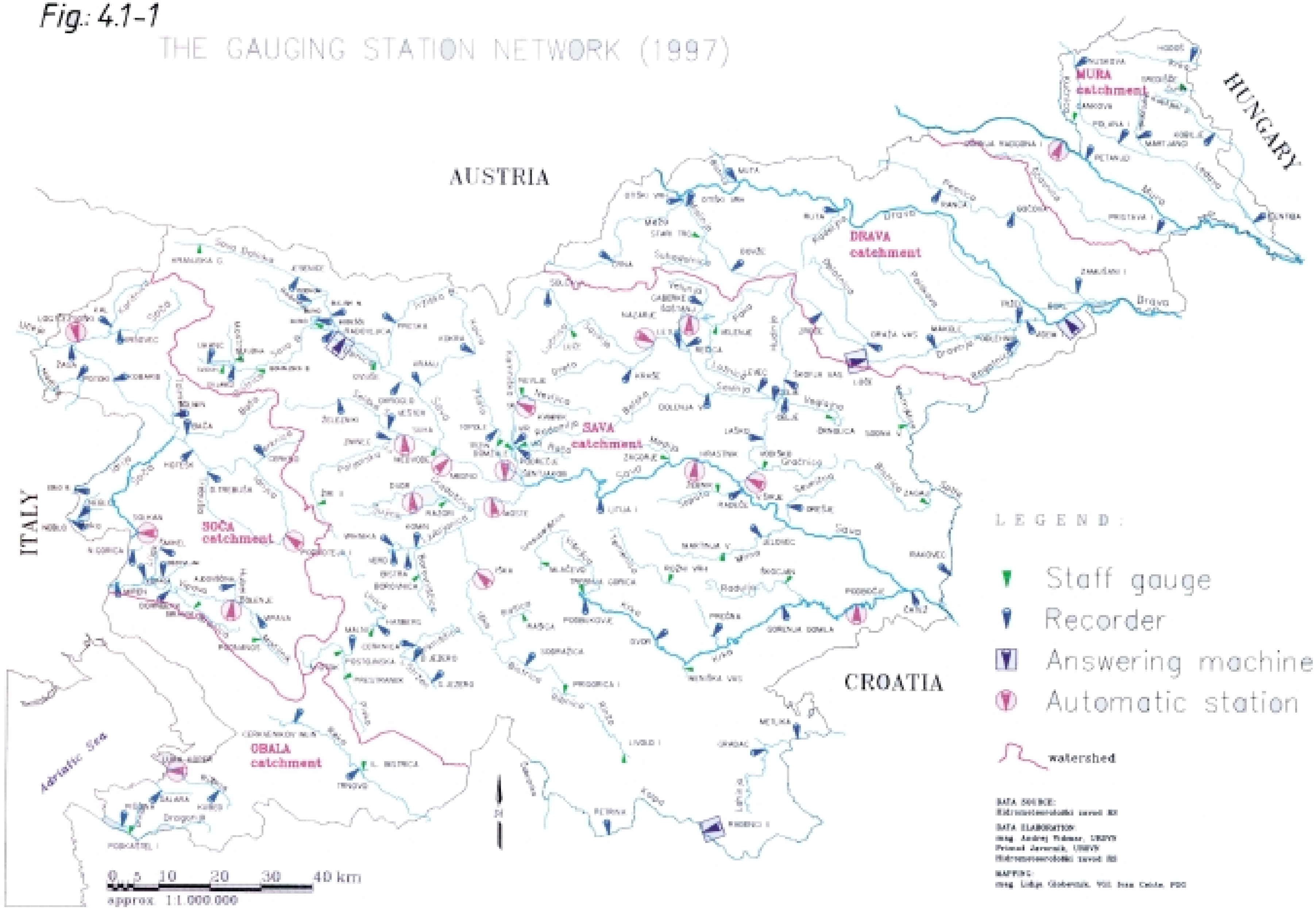


Fig: 4.1-2

WATER QUALITY SAMPLING STATION NETWORK (1997)

In the Annex 4.1 are given in the Table 4.1-1 names and characteristics of the sampling sites. Coordinates of each sampling station are given in Table 4.1-1 and in complementary Table 4.1-2 which is a copy of the Table 1 from HMI (1998b) and is showing a list of gauging stations with over five years observation period, with these relevant data: catchment area, geodetic coordinates (global, although we use local: X, Y, i.e. Gauss-Krueger coordinates), "0"-point m a.s.l., period of observation (begin, end, No. of years). In the Table 4.1-1 we added numbers in brackets, e.g. 22/98(97) which mean that besides 22 years of continuous monitoring with the last year 1998, the data are available (elaborated) for up to 1997.

Frequency of sampling on TNMN in 1996 (Research of Surface Water Quality in Slovenia in 1996, HMI (1997)) is given in the Table 4.1.-3 below:

Table 4.1.-3 Frequency of sampling on TNMN in 1996

River Name - Sampling Station	Ph,Ch,B	S	Me	Organic Compound				M.O.
				GC/MS w	PCB w	AOX s	EOX w+s	
Drava Ormož	11	2	1	1	1	1	1	4
Sava Jesenice	11	2	1	1				5

Ph, Ch, B physical, chemical and bacteriological analyses
S saprobiology
Me metals
M.O. mineral oils
w water
s sediment
GC/MS recording of spectrum in water and sediment
PCB polychlorinated biphenyl
AOX adsorbed halogenated organic compounds
EOX extracted halogenated organic compounds

Sediment quality is measured on roughly 35 locations (depends from year to year), the determinations also vary from site to site, i.e. only some metals, or more comprehensive, including organic compounds, PCBs, AOX, EOX, mineral oils, etc. The detailed data can be obtained in the reports of monitoring at the HMI, or summarized in the annual reports on the status of the environment or on the water quality.

4.2. Data Quality Control and Quality Assurance

Surface water quality monitoring program is done by HMI, which also co-ordinates the work of all co-operating institutions. Implementation (monitoring/analyzing) is done by:

HMI (Hydrometeorological Institute)

- physical, chemical and saprobiological analyses
- metals
- data base (maintenance, services for third parties)
- co-ordination
- technical preparation of report(s)

NIB (National Institute of Biology)

- part of saprobiological analyses

Institute for health protection Maribor, Environmental protection institute

- analyses of metals and organic compounds

Institute for health protection of Slovenia

- bacteriological analyses

Additionally, HMI water quality laboratory is going to be accredited according to European norm EN 45001 for test laboratory.

Sampling and preparation of samples

Water and suspended solids sampling for physical and chemical analyses are done according to international standards (HMI, 1997):

- ISO 5667-6 water sampling
- ISO 5667-3 conserving and handling of samples

Environmental protection institute in Maribor does analyses of metals and organic compounds in water, suspended solids and sediment. Samplings are done according to the following standards:

- ISO 5667-6: since 1990 water and suspended solids sampling
- ISO 5667-12: since 1994 sediment sampling
- ISO 5667-3: since 1985
- ISO 5667-2: since 1991 samples preparation on field, transportation and storage

Samples are transported in cold-storage plant in mobile laboratory. Determinations of parameters are made as soon as possible, otherwise the samples are stored according to standards.

Laboratory analyses

Quality control and quality assurance for laboratory analyses are realized with control charts, using standard reference materials or internal standards and with co-operation in interlaboratory calibration exercises. Control charts are made for all spectrophotometrical analyses, fluorescence spectrophotometrical analyses, and FAAS. Control charts for titrimetric analyses are in preparation. HMI water quality laboratory is co-operated in following comparison schemes between laboratories (results are good):

Surface water, sediment:

- EQUATE 1995 (1), 1996 (1), 1997 (1)
- QualcoDanube 1995 (2), 1996 (4), 1997 (4), 1998 (1)
- AQUACHECK 1996 (5), 1997 (2)
- PHARE 1996 (1), 1997 (2)
- MAPEP 1996 (1), 1997 (1)

Calibration certificate for mass balances and digital burettes is done yearly by State's authorized laboratory.

Data for period 1982-1997 (present data still in evaluation) are saved in electronic database on HMI. Data controls are made by ions balances, control of limit values (range) for COD, BOD_5, DO, hardness, etc. Minimal, maximal and average values are computed from data. Since 1998 data are saved in the database Labod (Laboratory information system for expertise and business – In Slovenian: Strokovno in poslovno upravljanje analitskega laboratorija). The same database Labod is used in Environmental Protection Institute Maribor, and some other laboratories.

The list of used standards and standard methods used by each of aforementioned water quality monitoring institutions is given in the Annex 4.2 in Table 4.2-1. In the same table is also indicated whether the determination is done with filtered or unfiltered sample and for which method standard reference material is used (certificate of analysis).

Water and suspended solids sampling for physical and chemical analysis is done according DIN 38402-T15 and ISO 5667-T6 standards. Sampling of sediment is done according DIN 38414-T1 standard. At one site, all the samples (i.e. for all determinations) were taken at the same time. Sampling of water was done in 0.5 m depth in the mainstream. If water depth was less than 1 m, sample was taken at mid-depth. At the moment of sampling, air and water temperature, transparence, pH, electric conductivity, free CO_2, and DO (dissolved oxygen) are measured at the site. Samples for determination of nitrite, chemical oxygen demand (COD), color, and phosphates are conserved, samples for determination of detergents, phenols, mineral oils, and formaldehyde are cooled. In unfiltered, mixed samples, suspended solids (SS) are analyzed and COD, BOD, phenols, and detergents determined. The unfiltered, but sedimented sample is used to determine ammonium and nitrite ions, actual color, mineral oils, formaldehyde and ligninsulphonates. Other analyses are performed on samples filtered in Filtrak 388 (HMI, 1994, 1996, 1997).

4.3. Data Consistency, Compatibility and Transparency

Documentation of uniformity and consistency of data

HMI is the institution authorized to do the national monitoring. The authorized institution must follow the procedures stated in ISO 9 000 series and EN 45 000 series of standards. Subsequently, the work done by other institutions, which are assigned by HMI, has to comply with the same standards and procedures used by HMI. In the Annex 4.2 we present compilation table 4.2-1 of the procedures, standards, and methods for sampling, analyzing, evaluating and representing the measured parameters.

Determinations of total nitrogen N_{tot} comprise only inorganic forms of nitrogen, i.e. nitrite NO_2 (unfiltered), nitrate NO_3 (filtered), and ammonia NH_4 (unfiltered) ions. Organic forms are not determined, unless in special cases. If the mass balance is needed, it can only be estimated via calculation of biomass, either by measured chlorophyll-a (chl-a), or measured concentration of volatile solids.

The same is valid for phosphorus P, where total phosphorus P_{tot} indeed means total inorganic orthophosphate PO_4 in filtered sample.

Filtering of water samples is done with standard procedure on standard filter with 0.45 μm (filter with black stripe). Determinations in sediment are done for the particles smaller than 65 μm. coarser particles do not contribute significantly to adsorbing properties of sediment (small total surface area). The same is valid for suspended solids.

Anomalies and incompatibilities in the data

The systematic error is kept as low as possible, but measuring errors are random. With the implementation of the ISO 9 000 standards, measuring, analyzing, and presentation errors shall be negligible, or at least properly estimated and are given with the result as the expected standard deviation.

Another source of error might be changes in the analytical procedures, or equipment used. In past, this was unfortunately not consistently recorded, but can be reliably deduced from the accompanying documentation, kept at the laboratories (e.g. protocols, standard procedures, acquisition of apparatus, etc.).

Synthetic data

There are no synthetic data obtained with simulation modeling. Still, rough measured data are subject to statistical and expert checking and judgment before final acceptation and further processing. In this phase measurements errors are smoothed out, missing data inter- or extra-polated, and other quantities calculated on their basis. This part of data elaboration and evaluation is within the inherence of the authorities who execute monitoring - raw data are usually not available, the only data publicly available are such elaborated and suitably interpreted data, which can be found in cited reports.

Hierarchy and transparency of the data

As said in the paragraph above, the raw data are elaborated in a way to give reliable and compatible information on the national level. For most of the purposes this information is adequate and can be used in further analyses or compilation. A lot of these analyses are already done by the HMI and compiled in their annual reports. On request, user can get lower levels of (interpreted) data for his/her own analyses. These data are usually paid on the basis of actual work and media needed for their preparation.

Final conclusion would be that the data can be obtained at different levels of elaboration, aggregation and transparency, but usually the needed level and quality can be got.

4.4. River Channel Characteristics

4.4.1. Network

The main data can be obtained from EPR (1997) and HMI (1994, 1996, 1997) reports. A map of the river (drainage) network, with watershed delimiting Black Sea and Adriatic, is given on Figure 4.4.1-1 on the following page. A similar map can be found in the Part A (Ravbar *et al.*, 1998). A brief summary is as follows:

Slovenia covers an area of 20 255 km^2 and has almost 2 million inhabitants (1 998 477 at the end of 1994). The net growth rate of population, i.e. natality and immigration minus mortality and emigration, tends to be negative in last few years (ZS, 1996, 1997). The Danube River basin covers 81% of the Slovenia's territory (16 480 km^2), hosting 80% of the population. The other 19% of the territory (3 775 km^2) is drained into the Adriatic Sea (directly, or indirectly). Among the 17 riparian countries contributing to the Danube River basin, the Slovenia's part is only around 2% of the total area of the basin. The longest river is Sava, which is from operational reasons divided in 3 sub-catchments. Kolpa River is border river with Croatia and confluence in Sava on the Croatia's territory. Sotla River is also border river, with the confluence with Sava lying on the border. Two other major rivers Drava and Mura come in Slovenia from Austria and leave into Croatia. South-Western part of Slovenia is typical carst – for which is characteristically absence of surface watercourses, with exemptions in dolinas (a carstic valley with impervious bottom (heavy soils) at which rivers flow and can also flood several times per year).

4.4.2. Channel Cross Sections

On average, all major river courses have measured cross sections on a 400 m span. Some more important stretches (e.g. due to power production, flood protection, etc.) have even denser cross sections (up to 1 per 100 m). Thus, the longitudinal section is also known. Usually, the left and right bank elevations are also given along with the bottomline. The data can be obtained from the HMI, Geodetic Institute of Republic of Slovenia, VGI, local river authorities (under construction, at present Water Management Companies), and other companies which deal with water. A lot of data is also available at the Hydraulic Department of the Faculty of Civil and Geodetic Engineering. The river cross-sections are presented in Annexes 4.4.2., i.e. Annex 4.4.2.-1 gives tabulated data, while in Annex 4.4.2.-2 there are shown sketches of the flow measuring stations.

Fig.: 4.4.1-1
Map of the river (drainage) network of Slovenia

4.4.3. Gradients

On average, all major river courses have measured cross sections on a 400 m span. Some more important stretches (e.g. due to power production, flood protection, etc.) have even denser cross sections (up to 1 per 100 m). Thus, the longitudinal section is also known. Usually, the left and right bank elevations are also given along with the bottomline. The data can be obtained from the HMI, and other institutions (see paragraph above). Basic data on the river network is also available in the Water-management Elements (VGI, 1976).

The river longitudinal-sections (gradients) are presented in Table 4.4.3-1 in the sequel and on maps in Annexes 4.4.3-1 through 4.4.3-3. From the point of Water Quality Modeling (WQM) it is interesting to point out that the majority of rivers, except Drava, and partly Sava (which are impounded) have relatively steep gradients (surface-line) and inverts (bottom-line) and have thus relatively high velocities which in turn facilitate oxygen uptake. This means that higher pollution loads with degradable organic can be detected without significant impact on ecosystems (oxygen depletion, for instance). Short travel distances from the origin to the outlet of the country (on average, less than 200 km) also mean that algae do not have enough time to develop although there might be favorable conditions in the water (latent eutrophication).

Table 4.4.3.-1 River longitudinal sections

SECTION	KILOMETRE		ΔL	ΔH	I
	[km]		[km]	[m]	[%o]
DRAVA					
1	147.00	119.00	28.00	32.40	1.157
2	119.00	90.00	29.00	41.80	1.441
3	90.00	59.00	31.00	30.60	0.987
4	59.00	30.00	29.00	32.20	1.110
5	30.00	0.00	30.00	22.42	0.747
			147.00		
MURA					
1	134.00	104.00	30.00	40.44	1.348
2	104.00	71.00	33.00	37.00	1.121
3	71.00	50.00	21.00	10.92	0.520
			231.00		
SAVA					
1	946.00	944.38	1.62	3.90	2.407
2	944.38	910.30	34.08	327.70	10.936
3	910.30	862.79	47.51	151.30	3.185
4	862.79	830.12	32.67	61.00	1.867
5	830.12	804.41	25.71	38.10	1.482
6	804.41	780.72	23.69	21.30	0.899
7	780.72	755.00	25.72	31.60	1.229
8	755.00	729.10	25.90	23.40	0.903
			133.69		

4.4.4. Flood Plains

Significant part of the Slovenian territory is subjected to flooding. In past decades a major part of water management in the catchments was to prevent erosion and flooding. About 10% (i.e. 2,490 km) of low-land water courses are trained (regulated), some of them have also flood protection embankments (EPR, 1997, p. 57). The extent of flood plains is given in EPR (1997, p. 56) in Table 5.2: Main characteristics of river basins. To summarize, here is an excerpt from that table:

Table 4.4.4.-1 Extent of floodplains

River Basin	Flood plains [ha]
Mura	18,700
Drava	16,000
Sava	31,700
Total Danube River basin	66,400

A more detailed picture on the floodplains can be obtained from the Figure 4.4.4-1 on the following page and from the Figure 4.4.4-2: Map of Reservoirs and Floodplains in the Annex 4.4.4 (copied from VGI, 1976, map K-5.1).

Fig.: 4.4.4-1:
LOCATION OF FLOOD PLAINS

4.4.5. Wetlands

From EPR (1997, p. 81) we can cite that:

"Like elsewhere, the wetlands are among the most endangered ecosystems in Slovenia. Twenty-two of them are already protected as important sites for endangered or rare species of wild flora and fauna. The share of inland wetlands and ponds is significant in the main river systems, where the main threat is the construction of hydrological and engineering structures that are detrimental to their ecological and environmental integrity. Today the overall wetland surface is decreasing, in particular in the coastal area, because they are filled in, or drained and used for construction. Slovenia has currently only one site on the List of Wetlands of International Importance (Sečoveljske soline = marine salt-works), although, according to IUCN, 6 were recorded in 1965 covering 89 673 ha. In accordance with the Kushiro Resolution of the Ramsar Convention, a management plan is being drafted for the listed Ramsar site and a small group of experts has recently been set up (see Chapter 2, p. 30 of EPR, 1997). A national wetland strategy is also being drafted."

Record of the humid biotopes – wetlands in Slovenia is still incomplete. The last assessment was in 1992 by P. Skoberne (see Annex 4.4.5.-2). It is estimated that wetlands cover around 26 000 ha or 1.3% of surface. Of them, in the DRB, some 10 500 ha are already protected as a part of a natural park, which represent 17.5% of all protected areas in natural parks in Slovenia. Half of protected wetlands are situated in the Sava river basin.

More info about wetlands can be obtained in the accompanying reports Part A, and Part C.

In Table 4.4.5.-1 on the following page we present 5 wetlands which were identified as priority issues in the NAP and approved in the SAP of 1995-2005.

In the Annex 4.4.5.-1 a map is given in which all major, or important wetlands in Slovenia are shown. Hydraulic loading for floods with return periods of 5, 10, and 30 years are neither measured nor could have been estimated (by appropriate experts). The information provided on the enclosed map and list was prepared for the IUCN publication by the section for nature conservation at the State Institute for Conservation of Natural and Cultural Heritage in 1992. Information from Central and Eastern Europe was compiled and published in *The Wetlands of Central and Eastern Europe*, IUCN-EEP, Environmental Research Series, 7, Gland, Switzerland, 1993. The map and the list included certain types of wetlands and water bodies that either, formed part of the protected areas or were identified as features of natural heritage. Since then new wetlands have been protected and currently a detailed inventory of Slovenian wetlands and their status is in preparation.

In the Annex 4.4.5.-2 a report on Slovenian wetlands for the European Commission is given, prepared by P. Skoberne in 1992.

Table 4.4.5.-1 5 wetlands from the NAP and approved in the SAP of 1995-2005

COUNTRY Name of Site	AREA (ha) Main Habitat(s)	FUNCTIONS	LEGAL STATUS	ACTION REQUIRED	ESTIMATED COST
SLOVENIA					
Cerkniško jezero Planinsko polje Ljubljansko barje	Freshwater lake - seasonal, rivers, seasonally flooded agricultural land, peatlands Total area: Cerkniško jezero: maximum water surface up to 26 km^2, Ljubljansko barje: approx 150 km^2, maximum water surface up to one third Agriculture, settlements, small industries	Wildlife, drinking water, flood control, tourism	Cerkniško jezero & Planinsko polje: proposed Regional Landscape park, Ljubljansko barje: proposed Landscape Park	Detail inventory of sources of nutrients, exact locations of diffuse sources, precise estimates of purification capacities, plan for the elimination of main sources of nutrients, complex plan of proposed solutions, evalation of monitoring systems	ECU 150-160 000 3-5 years
Drava and Mura Rivers	Rivers, reservoirs, wetlands, agriculture, industry, human setlements, sediments	Wildlife, endangered ecosystems, irrigation works, water supply, flood control, fisheries	Some local nature reserves and plans for the international National Park Drava-Mura (Slovenia, Croatia, Hungary, leading organisation: EURONATUR)	Detail inventury of sources of nutries, precise estimates of purification capacities, plan for the elimination of main sources of nutries, zonation of the area (buffer zones), complex plan of proposed solutions, evalation of monitoring systems	ECU 80-100 000 3-6 years
Golnik (near Tržič, Gorenjska)	50 ha degraded wetland	Biodiversity		Nutrient studies, wetland restoration	ECU 15 000
Prigorica (near Ribnica)	5 km^2 complex of wetland	Biodiversity, fisheries, flood control, recreation		Inventories, management plan, restoration, monitoring, nutrient studies	ECU 20-40 000
Zelenci - Spring of Sava River	5 ha Alpine wetland, minerotrophical bog Temporary agriculture run-off, acid rain, landfill leaching, road, influence of tourism (ski centre)	Wildlife, tourist attraction	Nature reserve froom 1990	Elimination of main sources of nutrients, elimination of main sources of erosion in influences area, maintenace of healthy conditions for wildlife, monitoring, curative actions	ECU 100 000 3-5 years

4.4.6. Erosion and Degradation

Land erosion and soil loss were already tackled in Chapter 3.1 Land Under Cultivation. Here we will only discuss in-stream erosion, i.e. erosion of river banks and bed. The torrential regime of the most tributaries to the main rivers Sava, Drava and Mura is responsible for high in-stream erosion and sediment transport. On impounded rivers, induced erosion is observed under, or downstream the impounding structures, due to sediment deposition in the impoundment and thus increased sediment demand downwards the river cross-structures.

Due to the torrential regime in upper parts of flow, and due to flooding in lower stretches, most of the river courses have been trained (regulated) already long ago. Nowadays, no major erosion or degradation points, except those in upper, torrential parts, are identified. It is true that river bed transport is not measured at any station in Slovenia. Thus no official data about river bed sediment transport or erosion is available. There exist only indirect data or estimations, based on gravel excavation (or river bed dredging) or based on estimations of washed-off land erosion deposits. These estimations vary for an order of magnitude for the same location and are thus non-reliable. Still, some general conclusions can be given, as follows in the following Table 4.4.6.-1 (compiled from VGI, 1976, Chapter 6) and text:

Table 4.4.6.-1 Calculated (Meyer-Peter-Mueller) sediment transport

River/Station close to border	Bed-load sediment m^3/a	suspended sediment t/a
Sava/Jesenice	65 000	612 000
Drava/Ormož	50 000	780 000
Mura/Mursko Središče	25 000	865 000

The Sava River has several gravel catching impoundment in its upper part, and also one big reservoir for HEPP Moste. This reservoir was not flushed for long period of years due to its toxic sediments (steel factory at Jesenice). But the part of Sava downstream the dam gets enough sediment from other tributaries, so the river bed is stable. Sediments are then trapped in the Mavčiče and subsequently the Medvode reservoirs. The latter was dredged few years ago and estimations (based on past experience) say that it will not need another dredging for 20 years. After some 20 years of operation of the Mavčiče reservoir, the first bed elevation measurements were conducted. The progress of sedimentation will be checked in following years. After Ljubljana, Sava flows in a canyon down to Krško. In this stretch only one HEPP impoundment is constructed, i.e. Vrhovo. Since it went into operation a few years ago, no experience with sediment deposits is present. Measurements of reservoir bottom elevation are planned to be done in future.

The Drava River is impounded in Austria and Slovenia. The in-stream HEPP in Slovenia have their reservoirs already filled with sediments, so they are regularly washing them during high flows – but this indeed means that they are merely letting through the sediments which are flowing from upper parts of the catchment. The sediment flow is discontinued at the reservoir in Maribor, as main water flow gets into a derivation channel to the Zlatoličje HEPP (SD I). Only during high flows the sediments are discharged into the old Drava River bed. After Maribor, Drava is impounded once again into the Ptuj Lake for the HEPP Formin (SD II). This lake is efficient sediment trap – it is estimated that very little bottom sediments are flushed out during high flows. After Formin, Drava River gets immediately into another impoundment Ormož Lake for the HEPP Varaždin in Croatia. To summarize, no significant erosion or other degradation of river is identified. The Mura River is not impounded in Slovenia due to moratorium on dam construction to preserve nature landscape and wildlife. But due to damming in upstream Austria, the sediment transport was discontinued. The consequence was that Mura has deepened its bed until it was properly stabilized with river training works. It is believed that sediment transport occurs only during high flows, but then its source is flushing of impoundment in Austria, so river bed is stable.

The main erosion points and river channel and banks stabilization structures can be seen on accompanying maps in Annexes 4.5 Dams and Reservoirs, and 4.6 Major Structures and Encroachments. As an information, sources of off-stream erosion are given on the map in the Annex 4.4.6-1: Erosion sources (Map K-6.1 from VGI, 1976).

4.5. Dams and Reservoirs

There are 5 major reservoirs in the Mura River catchment, 9 on Drava, and 6 on Sava. The numbers of dams are 26, 37, and 495, respectively (VGI, 1993a, p. 67-70). They can be seen on accompanying maps in Annexes 4.5 Dams and Reservoirs, and 4.6 Major Structures and Encroachments.

The reservoirs on Sava are lying on the river itself and are mainly for energy production. The same is valid for the biggest reservoirs on Drava, while the smaller ones are multipurpose. In the beginning, the latter were mostly meant for flood protection and irrigation, but nowadays fishers heavily exploit them, too. The reservoirs on Mura are off-stream, mainly for flood protection and river flow regulation. Fisheries exploit the ones, which do not get dry, too.

In the Table 4.5.-1 are given data for some major lakes.

Table 4.5.-1 Lakes and water accumulations (ZS, 1997)

Lake N = natural	River	Area ha	Max depth m	Total volume 10^6 m^3 = hm^3
Cerkniško (N)	Cerknica/Sava	2400	10.7	76.0
Ptujsko	Drava	346	12.1	19.8
Bohinjsko (N)	Sava	318	44.5	120.0
Vuhred	Drava	241	23.0	11.2
Mariborsko	Drava	239	10.7	13.8
Ledavsko	Mura	218	6.0	5.7
Vuzenica	Drava	196	10.8	7.5
Ožbalt	Drava	154	23.9	10.2
Dravograd	Drava	142	12.4	5.6
Blejsko (N)	Sava	140	30.6	31.7
Velenjsko	Paka/Sava	124	55.8	22.0
Šmartinsko	Savinja/Sava	107	7.0	6.5
Vogršček	Adriatic Sea	82	27.8	8.5
Zbiljsko	Sava	69	20.0	6.5
Moste	Sava	69	50.0	7.0

4.6. Other Major Structures and Encroachments

Although flood protection has a long tradition in Slovenia, and almost all frequent flood areas are protected, there is only around 20% of total river length trained with structures and/or encroachments. The main structures are (1) dams that reduce the slope of the bottom and thus reduce the speed of water, and (2) longitudinal bank encroachments. Not many river stretches are rigidly trained (channalized) with solely artificial material, and even these will be re-naturalized during necessary maintenance or reconstruction works. These structures can be seen on accompanying maps in Annexes 4.5 Dams and Reservoirs, and 4.6 Major Structures and Encroachments.

4.7. Major Water Transfers

According to the TOR, the major water transfer is defined when more than 10% of mean monthly low flows in streams is extracted (or augmented), regardless if it goes for consumptive, or non-consumptive use (i.e. return flow). The transfer is occurring at an intra-basin or inter-basin level.

The only two major transfers are on river Drava for energetic purposes, where the flow (300 m^3/s) is diverted into a channel, leaving into the old river bed only the minimal (ecologically needed) flow to sustain aquatic life (around 10 m^3/s, depending of the season). These two HEPP's are Zlatoličje (SD I) and Formin (SD II), see Annex 4.5 Dams and reservoirs.

On a very local scale there can be identified some other transfers of more than 10% base flow, but this is not important for Slovenia or even transboundary. These transfers occur mainly during summer when a lot of water is needed for agriculture – somewhere all the flow from a stream is pumped out. An example of such a use is river Savinja in Savinjska valley where water is needed to irrigate hoops. Another example of excessive transfer is mini HEPP's, where can also happen that the original stream gets dried. In fact, this should not happen, as permissions for the irrigation or power production clearly state what percentage of the original flow can be used. The problem is in monitoring and inspecting.

4.8. Preferred Sampling Stations and Data Sets

This chapter provides information on the results of frequent synchronous measurements of water discharges, sediment transport and water quality from:

i. all stations included in the TNMN
ii. the closest station upstream of each hot spot
iii. the closest station downstream of each hot spot
iv. the station closest to each national border, on Slovenian side of the border (NB: should be: on each side of the border, but Croatian data are at their discrete), for the Danube River and tributaries
v. the station closest to the confluence of each tributary with the Danube

All in all, this chapter provides information about practically all relevant water flow and water quality measuring stations and monitoring data in DRB part of Slovenia.

As a rule, there are no synchronous measurements of water discharges, sediment transport and water quality. Of sediment transport, only suspended solids (SS) are measured as a part of physic-chemical water quality. Sampling sites for physic-chemical and/or biological water quality are not the same as sites for water flow measurements (see the attached maps). When water quality sample is taken at a specific point, flow is obtained for that specific point from the closest water-level gauging station – this operation is done by HMI.

ad (i) all stations included in the TNMN

There are only 2 TNMN stations in Slovenia, both in front of Croatian border, the first one is on river Sava at Jesenice (station No.: 3860), and the second one is in the Ormož lake on the river Drava (station No.: 2200), (see also Chapter 4.1 to get info about sampling rate and parameters monitored).

ad (ii) the closest station upstream of each hot spot

As we have listed our hot spots practically all over the country, there are quite a number of upstream stations. Additional number comes for downstream stations, so we have listed all important stations.

ad (iii) *the closest station downstream of each hot spot*

The same as above for the upstream stations!

ad (iv) *the station closest to each national border, on Slovenian side of the border, for the Danube River and tributaries*

(NB: should be: on each side of the border, but Croatian data are at their discrete)

The closest stations are the two TNMN stations on Sava and Drava, and national station on Mura at Petišovci near Lendava (station No.: 1260)

Ad (v) *the station closest to the confluence of each tributary with the Danube*

Slovenia has no river with direct confluence with the Danube. For this purpose, refer to point (iv), above.

The institution, which is responsible for water level/flow measurements and also for water and sediment quality, is the HMI, i.e Hydrometeorological Institute of the MoEPP (Ministry of Environment and Physical Planning). They should also measure bed load sediment transport, but this is not done. Only suspended solids are measured as a part of water quality determination. If any measurements are done by other institution, this is subordinated to HMI, so the end user (of data) indeed does not see the difference.

4.9. Water Discharges

Water discharges are compiled and reported for the years 1994-1996 only, as the data for the year 1997 are still not elaborated by the HMI and released for public use. In the Table 4.9.-1 on the following page are given the water level/flow gauging stations for which the continuous flow measurements exist. The same, but more detailed table is given in the Annex 4.9. in the Table 4.9.-2.

The instantaneous flow rates for times when there are simultaneous measurements of water discharge and either sediment or water quality parameters can be seen in the results of water quality analysis.

In Annex 4.9. are given in Figures 4.9.-1 graphs of discharges for the listed gauging stations. The dates are counted in days, beginning with 1st January, 1994 as day 1. Discharges are in m^3/s. on the graphs are with dotted vertical bars indicated days, when the water quality sample was taken.

Monthly average, maximum and minimum discharges for 1994-97 are due to enormous mass of data (daily values) given in the electronic form on the accompanying CD. In this report only a sample of how the database looks like is given in the Annex 4.9. in the Table 4.9.-3: “Data sample of water discharge”.

Table 4.9.-1 List of water level & flow (discharge) gauging stations

CODE	STATION	RIVER	TYPE	COMMENT
1070	PETANJCI	MURA	L	
1140	PRISTAVA I	ŠČAVNICA	L	
1260	ČENTIBA	LEDAVA	L	
2150	BORL	DRAVA	L	
2010	HE DRAVOGRAD	DRAVA	HE	
2138	JEZ MARKOVCI	DRAVA	HE	
2140	HE FORMIN	KANAL	HE	
	ORMOŽ	DRAVA	C	2150+2140+2900
2250	OTIŠKI VRH I	MEŽA	L	
2390	OTIŠKI VRH I	MISLINJA	L	
2650	VIDEM I	DRAVINJA	L	
2900	ZAMUŠANI I	PESNICA	L	
3015	KRANJSKA GORA	SAVA DOLINKA	V	
3080	BLEJSKI MOST	SAVA DOLINKA	L	
3200	SVETI JANEZ	SAVA BOHINJKA	L	
3250	BODEŠČE	SAVA BOHINJKA	L	
3530	MEDNO	SAVA	L	
3650	LITIJA I	SAVA	L	
3725	HRASTNIK	SAVA	L	
3740	RADEČE	SAVA	C	3725+6210
3850	ČATEŽ I	SAVA	L	
4206	MEDVODE	SORA		
4155	KRANJ II	KOKRA	L	
4430	VIR	KAMNIŠKA BISTRICA	L	
4695	JELOVEC	MIRNA	L	
4740	RAKOVEC I	SOTLA	L	
4820	PETRINA	KOLPA	L	
4860	METLIKA	KOLPA	L	
5080	MOSTE	LJUBLJANICA	L	
6068	LETUŠ I	SAVINJA	L	
6210	VELIKO ŠIRJE I	SAVINJA	L	
6340	REČICA	PAKA	L	
6720	CELJE II	VOGLAJNA	L	
7030	PODBUKOVJE	KRKA	L	
7110	GORENJE GOMILA	KRKA	L	

C = Calculated from stations, given in the Comment
L = Limnigraph
V = Water level gauge
HE = Hydroelectric power plant (discharge calculated from energy produced)

Besides for the period 1994-1997, monthly average, maximum and minimum discharges for thirty years long period between 1961-90 are in the Annex 4.9 in the Table 4.9-4: “Characteristic discharges of the 1961-90 period”.

In the Annex 4.9. in Figures 4.9.-2, we have reproduced flow duration curves from the Watermanagement fundamentals, VGI (1976). The same is still not available for the longer period, or updated with the data of 1961-90. Here, in the Table 4.9-5 we give just the summary for the crucial stations, i.e. the output station for the Sava River and input and output stations on the Drava and Mura rivers:

Table 4.9.-5 Mean flow-duration data for selected stations for the period 1926-1965

River/Station	Q0	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
Sava/Jesenice	1830	730	514	403	334	283	240	206	175	144	124	103	85
Drava/Dravograd	934	475	394	342	297	263	235	207	185	178	135	117	88
Drava/Ormož	1277	600	485	416	359	316	281	247	219	188	160	138	103
Mura/Cmurek	674	289	234	201	175	155	136	122	109	98	88	77	59
Mura/M. Središče	706	309	251	217	190	168	148	133	119	108	97	85	66
Kolpa/Metlika	658	216	136	95	72	56	44	35	29	22	16	10.5	8.9

4.10. Sediment Discharges

There were no measurements made for the assessment of sediment bed load transport. The estimated numbers diverge in a huge range of one order of magnitude and are thus very unreliable. For the purpose of estimating life-cycle of Slovenian reservoirs, before they get filled with sediments, a research is running where development of bottom of a few of impoundment for HEPP's is measured with echosonars and GPS's. Still, sediment transport during high flows will not be directly assessed within this study, but only indirectly by comparison of bottom elevations before and after the flood.

4.11. Suspended Sediment Concentrations for 1994-97, Reported as Computed (i.e., not transformed)

Instead of sediment bed load transport, suspended solids (SS), i.e. suspended matter, are measured routinely when water sample is taken for determination of water quality. There are also two automatic stations, which measure turbidity and SS. Unfortunately, these two are not the same as the two TNMN stations. The first one is just before the confluence of Savinja with Sava in Veliko Širje on Savinja. The second one is when river Mura comes fully from Austria to Slovenia on river Mura at Gornja Radgona.

In the Table 4.11-1 on the following page we give an example of how the database with sediment data looks like, i.e. there are reported daily values of SS transport in kg/s of total river flow. The same data on SS, but for 2 years span, is given in the Annex 4.11, in Fig. 4.11-1 for the both automatic stations.

Table 4.11.-1 Data sample of sediment discharge

1

HMZ R SLOVENIJE 2-OCT-98 SSOHP-program LP*
OVERVIEW FOR YEAR 1996 Code:1060

River: MURA Station: GORNJA RADGONA I
DATA TIPE : 4402-TRANSPORT OF SUSPENDED MATTER - DAILY VALUES - kg/s
"0" of Gauge: 202.338 m.n.m. Catchment Area : 10197.2 km2
Monitored Since : 16.07.1945 River Mouth at: 108.500 km

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OKT	NOV	DEC
1	.315!	.732	.990	3.78!	32.1!	23.7	26.3!	3.62	4.05!	8.23	3.36	.888
2	.307	.926	.924	5.38	23.5	12.2	17.1	1.12-	3.84!	7.78	6.40	2.32
3	.992	1.72	.990	10.2	15.5	16.7	218+	2.49!	5.83	27.3	2.11	2.48
4	.674	.599	.977!	11.2	13.6!	16.8	29.6	4.87	16.1	17.3!	2.19	.628
5	1.35	.356	.951	628+	11.0	8.45	16.6	2.65	20.9!	10.1	2.39	.727
6	.998!	.208-	.810	230!	7.50	9.42	8.94!	2.59!	25.4	31.6	1.92	1.27
7	.625	2.51	1.13!	197!	7.15!	3.42	3.34	2.95	23.3	19.8	7.31	.57+
8	1.46	.462	1.28	39.6	7.03	3.46	7.00	3.19	20.6!	27.5	2.01	.531
9	1.23	.564!	.451	30.3!	8.86	2.50	6.66!	3.88!	19.1	18.4	2.36	1.14
10	3.45	.579	.405!	24.1	24.9	2.08	5.54	3.60	15.6	17.4	1.73	1.66
11	4.56	.620	.289	13.7	37.0	1.74	12.2	3.93	8.24!	10.5	.744-	3.16
12	5.10	1.34!	.251	13.0	27.0	3.43	8.20!	3.30!	1.85-	6.25	1.19	.482
13	3.86	2.06	.174!	11.1!	44.2	4.25!	4.56	2.87	3.83	4.34	.892	.247-
14	3.19	.707	.063-	8.34	120	4.72	3.98	4.14	5.83!	20.6	1.02	.714
15	4.16	.773!	.063	3.39	716	2.46	3.58!	5.19!	9.12	25.4!	2.45	.964
16	3.64	.810	.396!	3.39!	1097+	1.77!	3.09	6.39	8.39	32.0	11.0	.476
17	5.68	.610	.745	3.62	94.5	1.07	3.11	2.88	7.96	37.9	95.8+	.470
18	3.15	.501!	2.89	2.82	70.8	1.03-	2.09!	2.50!	8.17	7.01	14.3	.340
19	1.55	.322	6.33!	2.55-	21.9	1.53!	1.96!	2.04	6.52	49.6	22.5	.671
20	2.33	2.99+	7.18!	6.82	19.4	2.00	.892	1.59	7.40	10.7	83.4	.573
21	5.93+	2.32	10.3	7.48!	21.5	4.53	1.89	1.88!	6.71	46.3	9.64	.732
22	3.64!	2.14	10.0	8.62	17.6	11.2!	1.25!	2.42	7.29	143	12.8	.366
23	3.64!	2.83	10.6!	34.0	17.9	30.1	.687-	1.58	17.6	457+	6.66	1.68
24	1.18	2.14	12.2	37.2!	9.63	19.5	1.05	3.02	232+	62.6	21.2	1.34
25	1.45	2.20	10.8	37.8!	8.56	12.2!	1.18!	2.43	199	49.3	3.56	.654
26	.428	2.62	27.9!	38.5	6.53-	8.30	.962	2.64!	37.9	32.8	2.56	.306
27	.146-	1.71	46.3+	45.1	45.9	21.4	1.28	2.40	15.5	10.7	3.14	.750
28	.998	1.61	34.6	30.1!	50.7	15.3!	1.17!	1.50	11.6	7.65	2.25	.373
29	3.56	1.29	16.3!	20.1	14.4	10.2	1.07	10.9!	9.78	8.47	1.76	.453
30	2.57		1.15	40.0	11.9	41.1+	.768	22.9+	9.10!	4.31-	2.58	.373
31	1.67		2.74		13.5		2.43!	4.86		4.33		.831

Sum:	73.86	38.24	210.1	1547	2617	296.5	396.4	122.3	767.9	1217	331.1	33.17
Urank:												
Dannk:	27	6	14	19	26	18	23	2	12	30	11	13
Snk:	.146	.208	.063	2.55	6.53	1.03	.687	1.12	1.85	4.31	.744	.247
Ssr:	2.38	1.32	6.78	51.6	84.4	9.88	12.8	3.95	25.6	39.2	11.0	1.07
Svk:	5.93	2.99	46.3	628	1097	41.1	218	22.9	232	457	95.8	5.57
Danvk:	21	20	27	5	16	30	3	30	24	23	17	7
Uravk:												

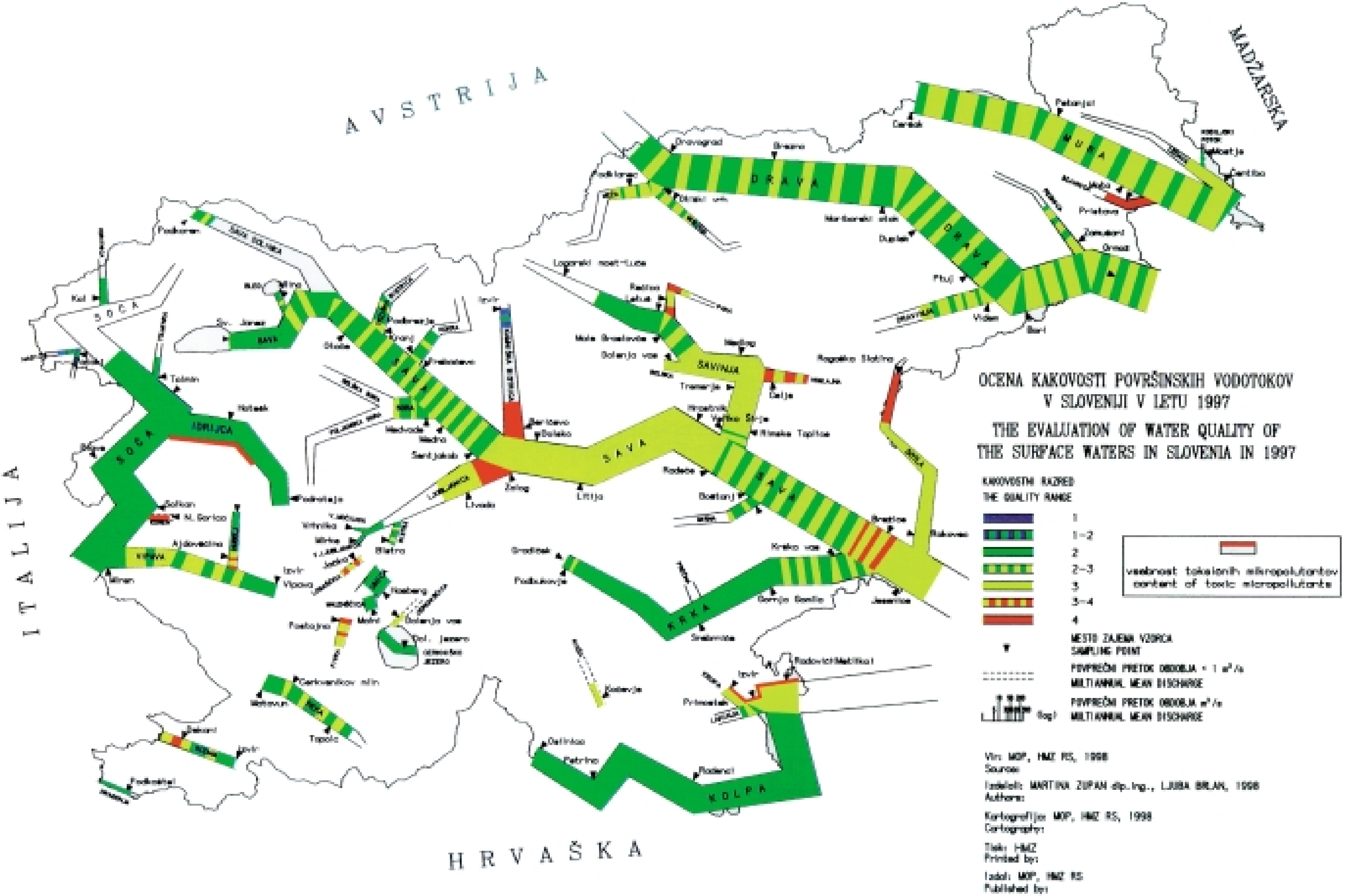
HOUR	DAY	SNK	SNP	SSR	SVP	SVK	DAY	HOUR
	14.03	.063	.063	20.9	1097	1097	16.05	

\+ maxi mean daily value - minimal mean daily value
!- probable value

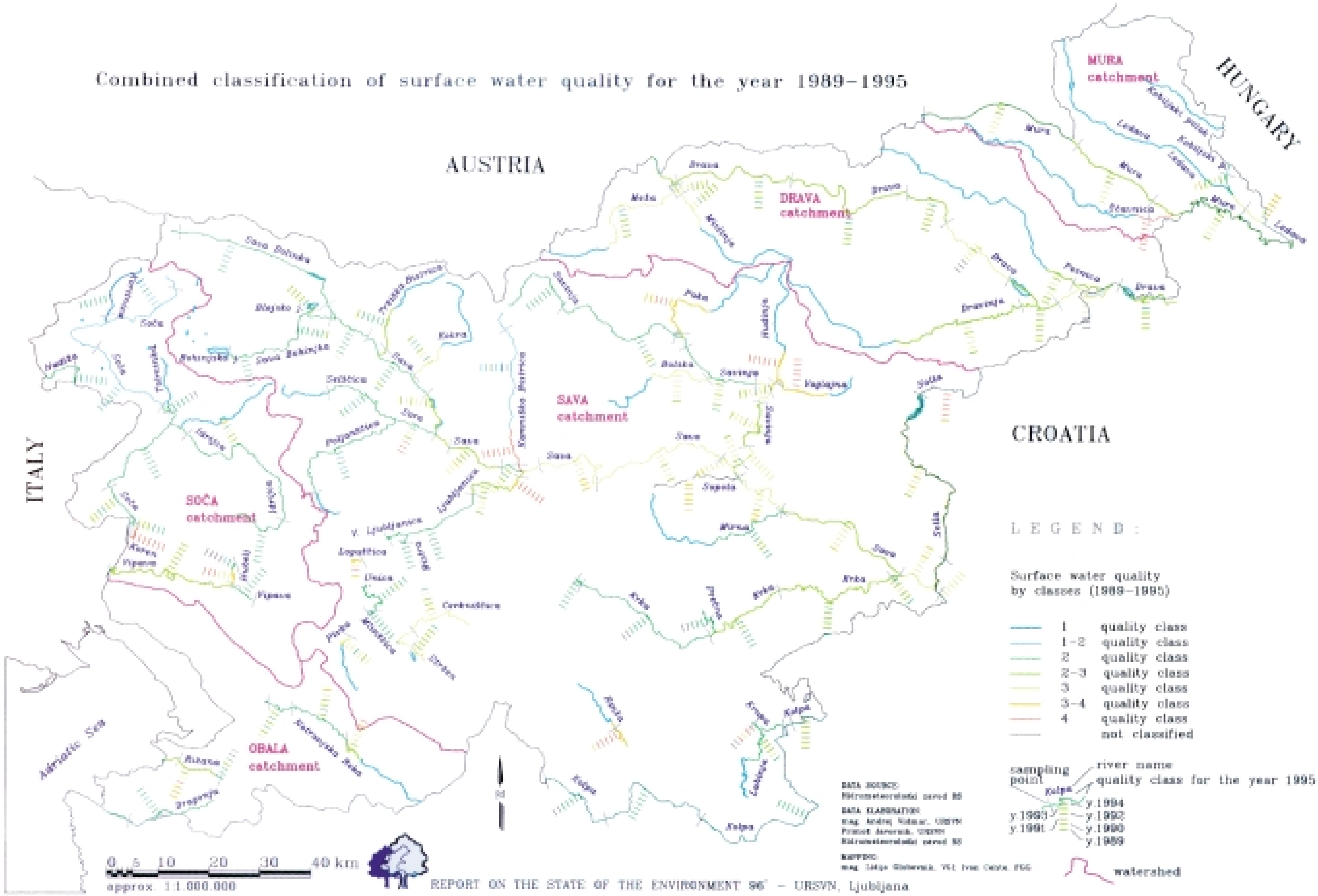
Urank -Hour of low stage
Dannk -Day of low stage
Snk -Low stage
Ssr -Average stage
Svk -High stage
Danvk -Day of high stage
Uravk-Hour of high stage

4.12 Water Quality Data

The whole chapter is based on the data from HMI (reports: 1996, 1997, 1998a, 1998b, etc., and raw data from their databases, still not evaluated). In the figures on the following pages we show the water quality in Slovenia, i.e., in Fig. 4.12-1 “The evaluation of Water Quality of the surface waters in Slovenia in 1997”, and in Fig. 4.12-2 “Combined classification of surface water quality for the years 1989-1995”.



OCENA KAKOVOSTI POVRŠINSKIH VODOTOKOV V SLOVENIJI V LETU 1997
THE EVALUATION OF WATER QUALITY OF THE SURFACE WATERS IN SLOVENIA IN 1997
KAKOVOSTNI RAZRED
THE QUALITY RANGE
1
1–2
2
2–3
3
3–4
4
vsebnost toksičnih mikropolutantov
content of toxic micropollutants
MESTO ZAJEMA VZORCA
SAMPLING POINT
POVPREČNI PRETOK OBDOBJA < 1 m³/s
MULTIANNUAL MEAN DISCHARGE
POVPREČNI PRETOK OBDOBJA m³/s
MULTIANNUAL MEAN DISCHARGE
Vir: MOP, HMZ RS, 1998
Source:
Izdelali: MARTINA ZUPAN dip.ing., LJUBA BRLAN, 1998
Authors:
Kartografija: MOP, HMZ RS, 1998
Cartography:
Tisk: HMZ
Printed by:
Izdal: MOP, HMZ RS
Published by:
AVSTRIJA
MADŽARSKA
ITALIJA
HRVAŠKA
MURA
DRAVA
SAVA
SAVINJA
KRKA
KOLPA
SOČA
IDRIJCA
VIPAVA
LJUBLJANICA
SOTLA
Petanjci
Ceršak
Dravograd
Brezno
Ptuj
Videm
Borl
Ormož
Celje
Laško
Litija
Zalog
Radeče
Brežice
Jesenice
Krško
Tolmin
Solkan
Ajdovščina
Vipava
Kobarid
Rogaška Slatina
Podkoren
Otiški vrh
Duplek
Mariborski otok
Zamušani
Gotovlje
Hrastnik
Rimske Toplice
Medvode
Mlino
Hotešk
Podsabotin
Miren
Vrhnika
Moste
Livada
Kostanjevica
Gornja Gorica
Boštanj
Jesenice
Brežice
Podbukovje
Gradišče
Ostrožno
Cerknica
Postojna
Kočevje
Primostek
Radoviči
Metlika
Radenci
Petrina
Osilnica
Podkraj
Sečovlje
Podkoritnik
Cerkvenikov mlin
Topolc
Izvir
Bača
Selc
Sv. Janez
Sava Dolinka
Kamniška Bistrica
Bled
Bohinjsko jezero
Cerkniško jezero


Combined classification of surface water quality for the year 1989-1995
AUSTRIA
HUNGARY
CROATIA
ITALY
MURA catchment
DRAVA catchment
SAVA catchment
SOČA catchment
OBALA catchment
Adriatic Sea
LEGEND:
Surface water quality
by classes (1989-1995)
1 quality class
1-2 quality class
2 quality class
2-3 quality class
3 quality class
3-4 quality class
4 quality class
not classified
sampling point
river name
quality class for the year 1995
y.1994
y.1993
y.1992
y.1991
y.1990
y.1989
watershed
0 5 10 20 30 40 km
approx. 1:1.000.000
REPORT ON THE STATE OF THE ENVIRONMENT 96' - URSVN, Ljubljana

4.12.1. Nitrogen

Total nitrogen, i.e. the sum of organic and inorganic nitrogen, N_{tot} is not measured. In this report, which summarizes the data available in Slovenia, N_{tot} merely means total inorganic N, (see also Chapter 4.3). Due to the fact that the composition of the total organic content in water is not precisely determined, but can only be guessed, the organic component of N can as well be only guessed, or roughly calculated via measured concentrations of chlorophyll-a, or measured concentrations of volatile solids.

Nitrogen is measured in surface- and in ground-water. Due to the fact that groundwater has less flow and longer resident times than the surface water, the concentrations of N in GW are usually higher in GW. In Slovenia the major source of water for preparation of drinking water is groundwater, so we are facing severe problems in some areas with intensive agriculture, e.g. Savinjsko polje, Dravsko polje, Apaško polje, etc.

We have identified some hot spots with high emissions of N which contribute to downstream eutrophication or drinking water problems – these are mainly livestock farms and some effluents of WWTP's in the areas where surface water recharges the groundwater. The other part of N concentration in surface- and ground-water is dispersed pollution, which is mainly due to agriculture and dispersed urbanization (around 50% of total population lives in settlements of less than 2 000 inhabitants!).

We see the nitrogen one of the most severe pollutants, as a great part of groundwater has concentrations of N permanently or often above MAC. For this reason, surface water will have to be considered as a more appropriate source for drinking water preparation (either directly, or through artificial recharge od groundwater). Some examples are the city of Celje in the Savinja valley, Ormož at Drava, and Ljutomer at Ščavnica/Mura, where positive studies to use river water instead of, or to recharge groundwater, have been made (Rismal *et al*., 1988).

4.12.2. Phosphorus

Much of what was said for the nitrogen is also true for the phosphorus. The true total phosphorus P_{tot} that shall comprise inorganic as well as inorganic fractions, is not measured. Instead, whenever P_{tot} is given, it merely means total inorganic phosphorus, i.e. total inorganic orthophosphate PO_4 in filtered sample on 0.45 µm filter (black ribbon).

Affected areas according to P concentrations are river stretches and impoundment, where the velocity is relatively low, or where residence time allows algae to grow. Namely, most of rivers, except Drava and Mura have origin in Slovenia, and leave Slovenia in a few hours or days, so there is no chance for algae to grow, although the concentration of P is enough high to cause eutrophication. This phenomenon we call hindered, or latent eutrophication. Still, some rivers in summer have low flows and then eutrophication problems can escalate. Such rivers are Krka, Sotla, Kolpa and some others, which are going to become a part of national parks, or heritage (e.g. Ljubljanica on Ljubljana moor).

Although phosphate free detergents are sold in Slovenia already for some years, population is still the biggest source of P, besides the dispersed sources of agriculture. So it is decided that P-elimination will be implemented on WWTP's whenever N-elimination is designed, or asked due to problems with preparation of drinking water. Of course, P and N-elimination will be implemented in the eutrophication sensitive areas, e.g. karstic water-courses and rivers with latent eutrophication.

4.12.3. COD

The most critical river stretches regarding COD and BOD_5 are the following: Kamniška Bistrica (which flows into Sava close to confluence of Ljubljanica and Sava, i.e. downstream Ljubljana), Sava upstream and downstream Ljubljana (until border with Croatia), Ljubljanica, Savinja, and Sotla. In all these rivers, mean yearly COD concentrations are above 10 mg/l, in Kamniška Bistrica even over 30 mg/l (1995), and over 67 mg/l in 1994. The above numbers are mainly due to point sources of pollution, i.e. untreated (or not enough treated) municipal and industrial sewerage.

Still, due to relatively high velocities of flow (torrential regime), the DO concentrations are normally quite high, so the high COD and BOD demand might not always have as negative consequences as it could in rivers with low reassertion.

At the contrary, high COD concentrations in groundwater may lead to anoxic and anaerobic conditions of groundwater, which in turn mean reduction conditions and increased level of pollution in groundwater (e.g. metals become soluble). Such problems are due to intensive agriculture prevailing on Ptujsko polje, Savinjsko polje, and in the Mura catchment.

4.12.4. Heavy Metals

In water and suspended sediments the contents of toxic heavy metals are usually well below the MAC values for drinking water. But, heavy metals and other toxic matter gets accumulated in sediments and can be resuspended during high flows (e.g. karstic springs, which are massively used for drinking water supply). In Drava River can be found in elevated concentrations Zn, Cd, and Hg. In Sava at Otoče station Cr, Ni, Cu, Cd, and Pb. In Sava at Dolsko also Hg is detected. In Ljubljanica at Zalog are present Cu, Cr, Ni, Pb, Cd and Hg.

Most of the heavy metals can be contributed to the past mining and industrial activities, some to present industrial activities and also to hospitals (Hg, radioactive substances).

In groundwater, most common pollutant is Zn (food additive in agriculture), Cu is also quite common (plant protection), while Cr^{6+} can be detected from time to time at different points (metal finishing industry, paints).

4.12.5. Oil and other hazardous Chemicals

The trend of mineral oils in surface water is increasing. The presence of (mineral) oil in water can be mainly contributed to traffic, and to leaching oil tanks in houses (oil for heating). Almost no surface water in Slovenia has concentrations below 0.01 mg/l, which is threshold between 1st and 2nd water quality class. The highest concentrations are in Mura, Meža/Drava, Sava, Kamniška Bistrica, Ljubljanica, Logaščica, Stržen, and Krka.

Of other hazardous chemicals are most important organic micropollutants, e.g. polycyclic aromatic hydrocarbons (PAH), polychlorinated biphenyls (PCB), and halogenated organic hydrocarbons which are adsorbed in water (AOX), or can be extracted from the sediments (EOX). In the latter group fall also pesticides. Phenols are also one of major pollutants, and are present in elevated concentrations in Sotla, Logaščica, and Savinja. For an overview, see Table 4.12.5.-1 in the sequel.

Table 4.12.5.-1 Analyses of organic compounds in rivers

	YY	MM	DD	∑ Pesticides	∑ PAH	AOX	∑ Atrazine
				[µg/l]	[µg/l]	[µg Cl/l]	[µg/l]
DRAVA DRAVOGRAD	94	7	28	0	0	-	-
DRAVA DRAVOGRAD	95	8	8	< 0.05	< 0.05	-	< 0.03
DRAVA ORMOŽ	94	7	28	0	0.005	-	-
DRAVA ORMOŽ	95	8	8	< 0.05	0.079	< 2	< 0.03
SAVA MEDNO	94	10	19	0	0	-	-
SAVA MEDNO	94	7	20	0	0.057	9	-
SAVA MEDNO	95	7	18	< 0.05	< 0.05	6	< 0.03
SAVA MEDNO	95	10	25	< 0.05	0.036	8	< 0.03
SAVA RADEČE	94	7	19	0.001	0.038	< 0.5	-
SAVA RADEČE	95	7	18	0.06	0.647	5	0.06
SAVA JESENICE	94	7	20	0	0.066		-
KAMNIŠKA BISTRICA	94	10	19	-	-	7	-
KOLPA METLIKA	94	6	1	0.07	0	-	0.07
KOLPA METLIKA	95	7	5	< 0.05	< 0.05	-	< 0.03
LJUBLJANICA ZALOG	94	10	19	00	0.018	7	-
LJUBLJANICA ZALOG	95	7	18	-	-	< 2	-
SAVINJA MEDLOG	94	8	8	0	0.039	-	-
SACINJA MEDLOG	94	5	25	0	0.015	-	-
PIVKA POSTOJNA	94	10	20	0	0	13	-
SORA MEDVODE	94	10	19	0	0	4	0
SORA MEDVODE	95	7	18	-	-	26	-

Biphenyls are still present at the Krupa spring (due to leaching from industrial store), but also in Drava. PAH’s are ubiquitous, but most important sites are Sava at Radeče (due to coal mining and wet separation in past), Drava, Sotla and Logaščica. AOX’s are usually higher, while EOX’s tend to have low concentrations (except Sotla at Rogaška Slatina, and Logaščica at Jačka).

Still, the most comprehensive is the value of all organic present, which can be obtained with gas chromatograph and/or mass spectrometer (CG/MS). These analyses show that a lot of groundwater and surface water are quite considerably polluted with unknown chemical compounds (could be metabolites of other identifiable pollutants). The lowest surface water quality was detected at Drava at Mariborski otok, Sava at Medno, at Radeče, and at Brežice, Savinja at Medlog, etc. Groundwater is critically polluted in regions with intensive animal breeding and intensive agriculture.

4.12.6.Special Linkages

a. Linkages between heavy storm runoff and non-point source pollution

   There are no simultaneous measurements of heavy storm runoff and pollutant loads. Still, from the knowledge of the phenomena, some conclusions might be drawn from the water quality at the automatic sampling stations and corresponding elevated flows in rivers due to high rainfall. From the point of view of suspended sediment and even more bed-load sediment, it is quite evident that the majority of the mass transfer (more than 50% for nutrients and approx. 90% for adsorbed pollutants, e.g. heavy metals) of any pollutant is effectuated during a few days of high flows.

b. Land use and water quality

Land use and water quality are connected through dispersed pollution. Thus the major disperse pollution sources are agriculture, mainly industrial crops growing (e.g. maize, hoops) and animal breeding which pollute with nutrients and plant protection agents. Another dispersed source of pollution is dispersed urbanization, i.e. villages and small towns up to 2000 inhabitants (PE), which do have neither sewerage nor WWTP's. In Slovenia, it is common that in such settlements houses have their own septic tanks. Due to misunderstanding of the concept of septic tanks by designers and inspectors, septic tanks are designs as no through-flow and thus without subsurface drainage system which can reduce organic pollution (carbon & nutrients) by 98%, and bacterial pollution to the same extent. People having such tanks are faced with high costs of regular emptying the tanks and subsequently "redesign" the tanks to get through-flow, but still without subsurface drainage. In this way groundwater is polluted with highly septic, anoxic wastewater and organic pollution as well as nutrients.

It is expected that MoEPP will lunch a program to help people properly upgrade their through-flow septic tanks with subsurface drainage, and also to provide small settlements with ready designs for suitable WWTP's for 50, 100, 200, 500, 1000, and 2000 PE.

c. Fertilizer sales and N&P in river water

There is almost direct connection between sold fertilizers and concentration of nutrients in river or groundwater. The use of fertilizers is still below European average and has trend to increase (1.6-fold from 1980-1995, according to HMI, 1998a) – see Table 3.1-6 in the text.

d. Detergent sales and phosphate in river water

The detergents produced and sold in Slovenia are without phosphates.

e. Air pollution and water quality

Air pollution is not regarded as a very important factor in water pollution. This is mainly due to the carbonate bedrock which gives good buffer capacity to groundwater and subsequently also to surface water. Although acid rain impact can be seen over one half of Slovenian forests, surface water (rivers, lakes, impoundment) do not suffer from acidification and subsequently increased pollution with other pollutants which dissolve in acid environment. The pH in our running waters is rather high, over 7, and usually below 8.

4.13. Sediment Quality Data

Additional to suspended sediment (SS) quality data, which is reported along with the water quality data, is here given an overview of the bed-load sediment quality. This sediment is characterized by grain or particle size between 0.45 and 63 μm, i.e. between filterable and settable matter. Note that particles bigger than 63 μm are thought to have too small surface (in comparison to total mass) that only a fraction of pollution is adsorbed on them. A Table 4.13-1 is given at next page, showing main features of settable sediment quality. Note also that concentration in sediment is given for the listed fraction in mg/kg sediment. To calculate the actual concentration of pollutant in the sediment, the granulometric curve of the bed-load sediment should be known! Thus, the numbers given in the table are much higher as the actual mass or concentration in the sediments!

Table 4.13-1 Maximal concentrations of heavy metals in sediments of water courses in 1989, 1994 and 1995

	Cu [mg/kg]			Zn [mg/kg]			Cd [mg/kg]			Cr [mg/kg]			Ni [mg/kg]			Pb [mg/kg]			Hg [mg/kg]		
	1989	1994	1995	1989	1994	1995	1989	1994	1995	1989	1994	1995	1989	1994	1995	1989	1994	1995	1989	1994	1995
1. Mura - Ceršak	72	25	51	215	110	310	5.7	1.0	0	29	26	53	31	30	60	177	38	78	0	0.06	0.10
2. Drava - Ormož	34	61	65	1402	380	1100	4.8	4.0	5.2	51	41	36	41	42	49	82	230	260	0	0.08	0.14
3. Sava - Medno	147	25	50	346	150	170	5.0	2.0	6.3	31	17	26	59	41	65	218	37	77	0.20	0	0.62
4. Sava - Dolsko	34	9	52	894	74	62	1.7	5.0	4.8	8	11	45	16	30	44	44	26	81	0	0	15.0
5. Sava - Brežice	0	16	37	0	180	390	0	4.0	5.4	0	16	71	0	33	78	0	51	62	0	0.22	0.21
6. Ljubljanica - Zalog	36	18	110	667	230	340	2.9	3.0	4.9	50	18	130	76	17	81	147	50	130	0.50	0.14	4.80
7. Savinja - Medlog	195	23	31	1117	100	260	11.7	5.0	4.1	0	42	54	258	45	69	150	47	68	0.20	0.06	0.06
8. Krka - Krška vas	49	20	25	210	110	230	2.4	0	6.3	0	26	23	93	42	46	35	55	71	0.17	0.07	0.08
9. Kolpa - Metlika	0	29	23	0	70	54	0	0	3.6	0	30	13	0	34	36	0	57	50	0	0.08	2.30
10. Vipava - Miren	28	/	97	250	/	200	1.6	/	4.0	11	/	53	23	/	85	90	/	79	0	/	0
11. Rižana - source	610	10	28	698	83	86	0	5.2	0	45	27	42	76	41	45	87	14	43	0	0	0
12. Soča - Plave	38	74	30	767	120	83	5.0	6.0	5.5	22	20	18	44	120	59	36	90	130	8.50	7.40	220

0 = under detection limit

5. Brief Overview of Legal and Institutional Framework for Water Quality Control

The analysis of hot spots and water quality data are related to legal and institutional framework which exists in Slovenia, and to foreseen forthcoming legislation of Slovenia and to existing legislation of EU, and trends in world (Agenda 21, etc.).

(i) Relevant umbrella legislation

Relevant umbrella legislation, enabling legislation and regulations which follow from that umbrella legislation is the Law on Environmental Protection (LEP), (OJ RS, 32/93). A number of daughter directives were since then issued regulating different aspects of environmental protection, e.g. air, soil, water, noise, etc. The complete list of relevant legislation on power is given in the separate book Part E: Common Annexes (copied from MEPP, 1997).

The new Slovenian legislation is being prepared in accordance to the existing EU legislation and to its trends. The main segments are identical to the ones in the Guide to the Approximation of European Union Environmental Legislation (CEC, SEC(97) 1608) and are as follows:

a. Horizontal legislation
b. Air Quality
c. Waste management
d. Water Quality
e. Nature protection
f. Industrial pollution control and risk management
g. Chemicals and genetically modified organisms
h. Noise from vehicles and machinery
i. Nuclear safety

(ii) The distribution of key mandates through the government hierarchy

The highest operational responsibility for the environment and as nature conservation in Slovenia is a matter of the Ministry of Environment and Physical Planning (MoEPP, or MEPP). The ministry has its minister, who is helped by State's secretaries. Its administrative and technical advisory body (for the scope of the DRBPRP) is the State Authority for Nature Conservation (SANC), consisting of three sub-sectors, i.e., (1) nature conservation, (2) environment, and (3) water management. There are organized several (8) regional institutes or branches which take care of natural resources use and protection, e.g. water management, conservation of natural and cultural heritage, etc. These regional centers act as technical supervisory bodies at the local level.

A special environmental board within the Slovenian Parliament deals with the environment, nature conservation and infrastructure. There are special bodies within this board, e.g. Council for Sustainable Development, National Biodiversity Council, etc.

The MoEPP SANC is responsible for issuing concessions, water rights, or approvals. If water is used for commercial purposes, a concession is needed. For the noncommercial use of water rights or approvals are needed.

The MoEPP HMI is responsible for monitoring water quantity and quality.

Within the MoEPP there are also inpectorates for water.

(iii) Applicable standards

The most important act is Environmental Protection Act (EPA), issued in 1993. Its mainline is along the EU legislation, but some corrections will have to be made to be compatible with the proposed EU Water Framework Directive.

The next act, the Water Act, is in the phase of acceptation in the Parliament. This act is prepared with the EU Water Framework Directive in mind.

Additional to these two basic acts, the National Plan for Environmental Protection (NPEP) is in preparation and waiting for confirmation at the Parliament. This act will define integral and holistic approach in planning and managing environmental issues. This act is also prepared with the EU Water Framework Directive in mind.

All three acts will define the policy of water management and planning, and thus elaboration of daughter directives and documents concerning preparation of basic cadasters, catchment management plans, revision procedures, etc.

(iv) Relevant international agreements

See Annex 5

Annexes

Annex 2.1.1.-1

Full Description of DEMO Projects for PHARE and GEF Funding in Year 1996

Common Notes for the Demonstration Projects of Slovenia Aiming for the PHARE and GEF Funding

Introduction

These notes are made to help properly judge the selected demonstration projects that will be submitted for the PHARE or GEF funding. It should be stressed that the demo and low-cost attributes have been mainly considered - so the extension of the problems is not within the ultimate and priority "hot spots" in the Danube river basin. Nevertheless, at local scale, all the problems given in this report have great value for the local community in the countries involved. Again, due to the local, i.e. limited extent of the problems, the mentioned problems can not be found explicitly stated in the Strategic Action Plan (SAP) or in the National Action Plan (NAP), although they comply completely with the goals of these documents.

Sources of information

Due to the rather limited problems, which are not reported in SAP for the whole Danube, the sources of information are expert knowledge supported with the projects or documentation on the specific problems.

Additional sources of information

The proposed projects can be well fitted into the SAP and mainly NAPs. The needed background information is readily available, mainly in the materials for preparation of SAP and NAPs. For Slovenia, these sources are:

1. According to the preliminary environmental assessment in respect to the Danube river basin made by local experts under the leadership of Haskoning, two reports can be cited:
   a. Danube Integrated Environmental Study - Phase 2 final Report for Slovenia. Water Management Institute, Ljubljana, April 1994
   b. Environmental Program for the Danube River Basin, Danube Integrated Environmental Study, Final Report. Haskoning, Royal Dutch Consulting engineers and Architects, July 1994.
2. The NAP for Slovenia (in preparation)

Relevance of the proposed problems

All the problems are involving at least two countries, i.e. they are trausboundary. They also show national interest (commitment) to solve them, i.e. to environmental protection and improvement. Besides that, the win-win aspect is stressed: the projects make economic benefits, reduce wastage of animal manure (nutrients) and needed application of artificial nutrients, bring multipurpose improvement of the environment and water use, etc. An important aspect is that through these relatively small international demo projects one can learn how to solve more complex international problems.

Problems tackled

There were identified several problems, which are mainly listed here:

1. The ecologically sustainable manure disposal and smell abatement for pig farm Podgrad
2. The problem of Vonarsko jezero impoundment
3. WWTP of tourist resort Rogaška Slatina
4. The revitalization of wetlands along with hydro-electric power use on river Mura (two proposals)
5. Cost-effective water quality management of the Sava river basin (two proposals)
6. Cost-effective water quality management of the Drava river basin (two proposals)
7. Institutionalization of water-communities
8. Problems of gravel-mining lakes etc.

The problems were jointly selected by Slovenian experts Uroš Krajnc, Ph.D., and Boris Kompare, Ph.D., the descriptions of the problems are partly due to assisting experts Mitja Rismal, Ph.D., Alojz Bitenc, Ph.D., and Andrej Kryžanowski, M.Sc.

B. Kompare, Ph.D.

Annex 2.1.1.-2

Table of the 12 Demo Projects for GEF/PHARE Funding

GR	TR	NO	NAME	PURPOSE	COSTS IN XEU			
					CNTRY	GRNT STUDY	GRNT EQPMT	SUM
HH			HUMAN HEALTH PROJECTS					
HH	D	9	Groundwater protection model for arable regions resp. expert: dr. Uroš Krajnc	Reduction of pesticides and nutrients in groundwater. Establishment of an efficient advice service for farmers. At the national level identified hot spots will be tackled (e.g. water supply of Ormož)	650.000	35.000	145.000	830.000
HH	S	2	Multi-purpose management of Sotla river • Improved WWTP of tourist resort Rogaška Slatina • Multi-purpose use of the impoundment resp. expert: dr. Boris Kompare prepared by: dr. Mitja Rismal and dr. Boris Kompare input from Croat experts is expected	To ensure the desired quality of the effluent from the municipal WWTP of a tourist resort in the function of the water quality in the downstream impoundment. To define the policy on adjacent agricultural land. To improve aquatic ecosystem and biodiversity. To develop regional and international cooperation. At the national level identified hot spot will be tackled (WWTP of Rogaška Slatina)	90.000 75% SI 25% HR	60.000	50.000	200.000
ID			INSTITUTIONAL CAPACITY BUILDING PROJECTS					
ID	D	5	Encouraging cooperation between small communities for water services resp. expert: dr. Uroš Krajnc	“Water communities” optimize the water services, potable water supply, sewerage systems and water treatment plants at the catchment basis	30.000	59.000	25.000	114.000
LU			SUSTAINABLE LAND USE PROJECTS					
LU	D	3	Management of waste from pig-farms in Slovenia resp. expert: dr. Boris Kompare prepared by: dr. Mitja Rismal and dr. Boris Kompare	How to treat the solid manure and slurry from big pig farms to reduce pollution and to increase recycling of the nutrients to the fields. Several case studies will be included. At the national level identified hot spots will be tackled (e.g. WWTP of Ptuj)	50.000	140.000	30.000	220.000

GR	TR	NO	NAME	PURPOSE	COSTS IN XEU			
					CNTRY	GRNT STUDY	GRNT EQPMT	SUM
LU	D	7	Ecologically sustainable manure disposal and smell abatement for pig farm Podgrad, Slovenia resp. expert: dr. Boris Kompare prepared by: dr. Mitja Rismal and dr. Boris Kompare	How to treat the solid manure and slurry from big pig farm Podgrad to reduce pollution and to increase recycling of the nutrients to the fields. Reconciliation of the existing project and purchase of the heavy-duty equipment.	50.000	150.000	900.000	1,1 mio
MP			MICROPOLLUTANTS PROJECTS					
MP	D	4	Contaminated sediments in quarry lakes resp. expert: dr. Uroš Krajnc	A program for reduction of input of nutrients and micropollutants in quarry lakes according to the use of water for public supply and recreation.	250.000	98.000	15.000	363.000
MP	S	6	Moste reservoir restoration project: Environmental management master plan and restoration preliminary design for the Moste reservoir in the upper Sava river basin resp. expert: Andrej Kryžanowski, M.Sc. prepared by: Andrej Kryžanowski, M.Sc., Zoran Stojič, M.Sc., and dr. Matjaž Mikoš	The project will demonstrate ways to overcome barriers in adoption of common objectives and will achieve changes in the sectorial policies in the river basin (applied in the upper Sava river basin) by introducing integrated water management. At the national level identified hot spot will be tackled (the Moste reservoir)	410.000	530.000	60.000	1,0 mio
WL			WETLANDS AND NATURE CONSERVATION PROJECTS					
WL	D	6	Improvement of biodiversity in a regulated river resp. expert: dr. Boris Kompare prepared by: dr. Mitja Rismal and dr. Boris Kompare input from Austrian colleagues is expected	On the example of Kučnica river between Austria and Slovenia a model of re-naturation of a regulated river will be elaborated. Regional & international cooperation will have to be developed. At the national level identified priority wetlands will be tackled.	7.000	53.000	30.000	90.000

GR	TR	NO	NAME	PURPOSE	COSTS IN XEU			
					CNTRY	GRNT STUDY	GRNT EQPMT	SUM
WL	D	8	Wetlands on Mura resp. expert: dr. Boris Kompare prepared by: dr. Mitja Rismal and dr. Boris Kompare input from Austrian and Hungarian colleagues is expected	To achieve ecologically sustainable exploitation of the rivers' water and of the riparian areas (wetlands, forests, etc.) natural capacity using up to date optimization and water quality management techniques. Regional & international cooperation will have to be developed. At the national level identified priority wetlands will be tackled.	75.500	272.000	30.000	377.500 =1/2 755.000 (A & SI) SI =1/2
WR			SUSTAINABLE USE OF WATER RESOURCES PROJECTS					
WR	D	1	Cost-Effective management of the DRAava and Mura River basins (CEDRA) resp. expert: dr. Uroš Krajnc	Definition of an integrated cost-effective management model for the whole Drava and Mura river catchments taking into account many conflicting interests of water and land use. The used decision-making tool will be promoted in details. At the same time institutional capacity building and development of an international cooperation will be built. At the national level identified hot spots will be tackled (e.g. water supply of Ormož, WWTPs of Maribor, Ptuj, Murska Sobota)	120.000	270.000	30.000	420.000
WR	D	2	Conflict resolution among users with competing interests resp. expert: dr. Uroš Krajnc	Multicriteria model for competing interests of electroeconomy, urbanization, farming, fishing, tourism, biodiversity, recreation, etc.	70.000	95.000	30.000	195.000
WR	S	1	Sava Catchment Management Plan Implementation (SCAMPI) • Integrated cost-effective management of the whole Sava River catchment • Integrated transboundary modeling tools • Navigability of Sava River resp. expert: dr. Boris Kompare prepared by: dr. Mitja Rismal, Alojz Bitenc, M.Sc., dr. Boris Kompare to be co-authored by Croat experts	Definition of an integrated cost-effective management model for the whole Sava river catchment taking into account many conflicting interests of water and land use. The used decision-making tool will be promoted in details. At the same time institutional capacity building and development of an international cooperation will be built. At the national level identified hot spots will be tackled (e.g. WWTPs of Ljubljana, Celje, Laško, ind. WWTP Goričane)	120.000	270.000	30.000	420.000

Annex 2.2.-1

Summary of Information for the Hot Spots

Main information is given already in the tables in the text (Chapters 2.2, 2.3, and 2.4)

Here, an abstract of the “identity card”, or “project files” for the hot spots from Part D: Water Engineering was intended to come. Reader is asked to consult the Part D, as at this time the relevant information is still not available.

Annex 2.2.-2

Monitoring of Critical Emissions of Hot Spots

Industrial Hot Spots

Brewery Union Ljubljana

Effluent	Date	Q	T	pH	Undissolved matter	Suspended solids	COD	BOD5	TOC	AOX	Ptot	Free Cl	Ammonia nitrate	Cu	Zn	Hg	Ni	Cd	Cr(VI)
		m^3/year	°C		mg/l	ml/l	mg/l	mg/l	mg/l	mg/l	mgP/l	mgCl/l	mgN/l	mg/l	mg/l	mg/l	mg/l	mg/l	mgCr/l
Year	1997																		
	1997	500,000	21.9	7.9	498.88	9.4	1955.02	979.26	410.7	-	7.08	<0.05	11.16	0.05	0.2	-	-	-	-

Brewery Laško

Year 1997
Q=595,470 m^3/year

Sampling point	Date	T	pH	Undissolved matter	Suspended solids	COD	BOD5	TOC	AOX	Ptot	Free Cl	Ammonia nitrate	Cu	Zn	Hg	Ni	Cd	Cr(VI)	Toxicity
		°C		mg/l	ml/l	mg/l	mg/l	mg/l	mg/l	mgP/l	mg/l	mgN/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	-
Before Bre.	1997	16.8	7.16	214.3	1.2	335	136.1	52.1	0.043	5.01	-	27.4	0.04	0.19	-	-	-	-	-
After Brew.	1997	18.8	7.25	308.1	0.8	1435	829	509	0.05	13.92	-	4.76	0.026	0.075	-	-	-	-	-

Pulp and Paper Plant Paloma Ceršak

Effluent	Date	No. of samp.	Q	T	pH	Undissolved matter	Suspended solids	COD	BOD5	TOC	AOX	Ptot	Free Cl	Cu	Hg	Ni	Pb	Cr(VI)	Cr tot
			m3/h(year)	°C		mg/l	ml/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Year	1997																		
	-	-	154.5	12.7	8	185	6	331	106	94.5	0.223	-	-	<0.1	0.001	<0.15	<.25	0.11	-
	-	-	145	16.9	5.4	64	13	189	55	26	0.004	-	-	<0.1	0.001	<0.2	<0.3	0.12	-
	-	-	97.3	20.5	8	161	1.5	318	159	94.4	0.354	-	-	<0.1	0.001	<0.2	<0.3	0.04	-
	-	-	112.3	22.6	8	141	11	382	132	86.6	0.145	-	-	<0.1	0.001	<0.2	<0.3	0.06	-
	-	-	128.4	14.3	8.4	75	7	309	126	84.7	0.126	-	-	<0.1	0.001	<0.2	<0.3	<0.1	-
	-	-	124.8	7.1	7.4	113	0.5	242	110	31.2	0.123	-	-	0.1	0.001	<0.2	<0.3	0.04	-
	1997	6	384,700	15.3	7.5	132	6.8	293	111	68.3	0.16	-	-	<0.1	0.001	-	<0.1	0.07	-
Year	1996																		
	16.1.	-	-	11	8.14	164	5.9	212	130	99.4	0.207	-	-	<0.1	-	-	<0.1	0.1	-
	27.2.	-	-	15.3	7.35	143	2	398	116	113	0.584	-	-	-	-	-	-	-	-
	10.9.	-	-	17.9	7.31	175	2	285	120	101	0.344	-	-	-	-	-	-	-	-
	16.10.	-	-	17.5	7.27	-	-	384	148	-	-	-	-	-	-	-	-	-	-
	25.11.	-	-	8.1	6.5	-	-	99	68	-	-	-	-	-	-	-	-	-	-
	11.12.	-	-	8.4	7.29	-	-	317	170	-	-	-	-	-	-	-	-	-	-
	1996	6	490,000	13.0	7.3	160.7	3.3	282.5	125.3	104.4	0.4	-	-	<0.1	-	-	<0.1	0.1	-
Year	1995																		
	1.9.-31.12.	2	284,000	-	-	-	-	446	-	-	-	-	-	-	-	-	-	-	-

Pulp and Paper Plant Paloma Sladki Vrh

Effluent	Date	No. of sampl.	Q	T	pH	Undissolved matter	Suspended solids	COD	BOD5	TOC	AOX	Cu	Zn	Hg	Ni	Pb	Cr(VI)
			m^3/year	°C		mg/l	ml/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Year	1997																
	1997	12	2,517,500	22.6	7.7	1153	49	739	168	68.9	1.03	0.117	-	0	0.18	0	0.061
Year	1996																
	1996	9	2,340,000	-	-	-	-	1069.0	-	-	-	-	-	-	-	-	-
Year	1995						Dissolved s.										
	15. 11.	-	-	18	8	1280	644	782	-	-	-	-	-	-	-	-	-
	6. 9.	-	-	26	7.54	2018	558	1392	-	-	-	-	-	-	-	-	-
	1.9-31.12	2	864,000	-	-	-	-	1079	-	-	-	-	-	-	-	-	-

Paper Factory ICEC Krško

Effluent	Date	No. of sampl.	Q	T	pH	Undissolved matter	Suspended solids	COD	BOD5	TOC	AOX	Ptot	Free Cl	Ammonia nitrate	Cu	Zn	Hg	Ni	Cd	Cr(VI)	Pb
			m3/year	°C		mg/l	ml/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mgN/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Year	1997																				
IA	1997	12	1,509,300	-	-	-	-	93	-	-	-	-	-	-	-	-	-	-	-	-	-
IB	1997	12	9,111,500	-	-	-	-	2288	-	-	-	-	-	-	-	-	-	-	-	-	-
II	1997	12	2,049,600	-	-	-	-	491	-	-	-	-	-	-	-	-	-	-	-	-	-
ISII	1997	12	5,134,600	-	-	-	-	171	-	-	-	-	-	-	-	-	-	-	-	-	-
III	1997	12	6,561,400	-	-	-	-	145	-	-	-	-	-	-	-	-	-	-	-	-	-

Leather Industry Vrhnika

Effluent	Date	No. of sampl.	Q	T	pH	Undissolved matter	Suspended solids	COD	BOD5	Ptot	Ammonia nitrate	Cr(VI)	Cr tot	Nonvolatile lipophilic matter	Sulphate	Sulphide
			m^3/h(year)	°C		mg/l	ml/l	mg/l	mg/l	mg/l	mgN/l	mg/l	mg/l	mg/l	mgSO4/l	mgS/l
Year	1997															
	21.-22. 1.		69.00	25	8.5	1038	0	3876	2555	0.07	157.6	-	1.5	440	-	-
	19.-20. 2.		61.96	25	7.5	620	0	2654	1725	-	184.6	-	1	-	-	-
	12.-13. 3.		84.00	26	7.5	652	<0.1	2066	1270	-	204	-	2.45	166	-	-
	16.-17. 4.		84.38	26	7.4	582	0	2268	1245	-	189.4	-	0.6	-	1207	1.05
	14.-15. 5.		61.96	30	7.7	476	0	2170	1470	-	198.1	-	0.3	-	1165	3.7
	27.-28. 5.		69.71	29	7.8	656	0	2651	1845	-	164.9	-	2.8	-	1109	2.9
	17.-18. 6.		50.92	29	7	502	0	3074	1945	-	180.4	-	1.9	-	1061	0.9
	9.-10. 7.		52.71	29	7.8	348	0	2261	1625	0.01	172.3	-	0.7	177	1230	3.9
	5.-6. 8.		71.08	29	7.5	434	0	2665	1605	-	132.5	-	0.8	-	1001	3.8
	16.-17. 9.		61.83	26	7.2	696	0	3265	1990	0.03	-	-	3.2	172.5	1117	1.9
	14.-15. 10.		78.04	26	7.3	882	0	3330	2050	-	181.1	-	1.8	277	1203	4.5
	11.-12. 11.		77.50	25	7.1	846	0	2999	1910	-	176.2	-	2.3	-	1227	1.4
	2.-3. 12.		93.92	22	7.8	676	0	3209	1640	-	138.9	<0.005	2.4	-	1129	1.1
	1997	13	82.25	26.7	7.5	646.8	0.0	2807	1760	0.0	173.3	<0.005	1.7	246.5	1145	2.5
Year	1996															
	10.-11. 1.		89.79	24	7.9	394	-	2320	1420	-	-	-	1.3	-	-	-
	21.-22. 2.		104.63	22	7.2	666	-	2856	1750	-	-	-	2.5	-	-	-
	13.-14. 3.		103.79	21	7.9	674	-	2779	1670	-	-	-	1.5	-	-	-
	10.-11. 4.		107.21	24	7.2	734	-	2973	1810	-	-	-	2.4	-	-	-
	21.-22. 5.		99.71	27	7.4	536	-	2478	1580	-	-	-	1.2	-	-	-
	11.-12. 6.		111.58	29	8.3	462	-	2925	1040	-	-	-	0.8	-	-	-
	3.-4. 7.		107.92	25	8.3	620	-	2315	1435	-	-	-	1.7	-	-	-
	20.-21. 8.		67.17	28	7.6	794	-	2963	2760	-	-	-	2.1	-	-	-
	25.-26. 9.		76.00	25	7.7	650	-	2468	1540	-	-	-	0.8	-	-	-

Leather Industry Vrhnika (continued)

Effluent	Date	No. of sampl.	Q	T	pH	Undissolved matter	Suspended solids	COD	BOD5	Ptot	Ammonia nitrate	Cr(VI)	Cr tot	Nonvolatile lipophilic matter	Sulphate	Sulphide
			m^3/h(year)	°C		mg/l	ml/l	mg/l	mg/l	mg/l	mgN/l	mg/l	mg/l	mg/l	mgSO4/l	mgS/l
	16.-17. 10.		61.29	26	7.6	366	-	1363	925	-	-	-	0.3	-	-	-
	13.-14. 11		81.42	27	8.4	552	-	2000	1430	-	-	-	0.8	-	-	-
	4.-5. 12.		80.29	24	7.7	694	-	2571	1620	-	-	-	3.7	-	-	-
	1996	12	582,589	25.0	7.8	595.2	-	2501	1582	-	-	-	1.6	-	-	-
Year	1995															
	7.-8. 9.		103.33	25	7.8	-	-	3190	-	-	-	-	-	-	-	-
	19.-20. 10		88.00	26	8.4	-	-	2783	-	-	-	-	-	-	-	-
	6.-7. 12.		91.29	24	8.2	-	-	2410	-	-	-	-	-	-	-	-
	1.9.-31.12.	3	208,700	24.7	8.1	-	-	2794	-	-	-	-	-	-	-	-

Dairy Factory Ljubljana

Efflu.	Date	No. of sampl.	Q	pH	Undiss. matter	Susp. solids	COD	BOD5	Ptot	Ammo. nitrate	Cu	Hg	Ni	Cd	Cr(VI)	Nonvolatile lipophilic matt.	Fats & Oils	Dissolved matter -at 105°C	Dissolved matter -at 550°C
			m^3/year		mg/l	ml/l	mg/l	mg/l	mg/l	mgN/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Year	1997																		
I	1997	18	225,600	10.2	621	5	2064	1481	10	3.3	<0.05	<0.001	<0.05	<0.005	-	225	-	-	-
II	1997	18	142,400	9.2	1252	12	4809	3183	13.5	6.6	<0.05	<0.001	<0.05	<0.005	<0.01	435	-	-	-
Year	1996																		
I	1996	5	263,895	10.2	458	7.3	2536	1179	7.2	-	-	-	-	-	-	-	165	1184	561
II	1996	5	118,681	9.3	1434	3.4	5866	2884	28.2	-	-	-	-	-	-	-	70	2506	825
Year	1995																		
I	1.9.-31.12.	2	88,000	7.9	795	-	2088	-	22.3	-	-	-	-	-	-	-	-	-	-
II	1.9.-31.12.	2	41,600	12.2	905	-	3254	-	22.3	-	-	-	-	-	-	-	-	-	-

Paper Radeče

Effluent	Date	No. of Sampl.	Q	T	pH	Undissolved matter	Suspended solids	COD	BOD5	TOC	AOX	Ptot	Free Cl	Ammonia nitrate	Cu	Zn	Hg	Ni	Cd	Cr(VI)
			m^3/year	°C		mg/l	ml/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mgN/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Year	1997																			
	1997	12	2,000,400	24.1	7.9	41.6	1.1	143	51	38.2	0.03	-	-	-	0	0	0	0	0	0.019
Year	1996																			
	1996	239	1,709,581	-	-	-	-	124.3	-	-	-	-	-	-	-	-	-	-	-	-
Year	1995																			
	1.9.-31.12.	77	600,000	21.5	7.34	530	-	628	100	-	-	-	-	-	-	-	-	-	-	-

Pomurka Murska Sobota

Effluent	Date	No. of sampl.	Q	pH	Undissolved matter	Suspended solids	COD	BOD5	TOC	AOX	Ptot	Free Cl	Ammonia nitrate	Zn	Hg	Cr(VI)	Nonvolatile lipophilic m.
			m3/h(year)		mg/l	ml/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mgN/l	mg/l	mg/l	mg/l	mg/l
Year	1998																
Kl.	2. 2.	-	77.15	7.6	300	5.5	1400	480	-	0.5	15	<0.1	31	-	-	-	86
Pr.	2. 2.	-	21.29	7.6	80	<0.1	270	120	-	0.41	5	<0.1	3.8	-	-	-	15
Kl.	10. 6.	-	9.55	7.1	410	1.8	1200	550	-	-	14.5	<0.05	14.5	-	-	-	-
Pr.	10. 6.	-	20.51	6.6	240	0.5	890	550	-	0.07	9.3	<0.05	-	-	-	-	113
Year	1997																
Kl.	1997	-	1,760,24	-	-	-	1200	-	-	-	-	-	-	-	-	-	-
Pr.	1997	-	3,093,30	-	-	-	880	-	-	-	-	-	-	-	-	-	-
Year	1995																
Kl.	1.9-31.12	1	399,693	8	70	0.1	370	180	80	-	-	-	-	-	-	-	-
Pr.	1.9-31.12	1	131,046	7.5	140	1	280	140	100	-	-	-	-	-	-	-	-

Dairy Factory Maribor

Effluent	Date	No. of sampl.	Q	T	pH	Undissolved matter	Suspended solids	COD	BOD5	TOC	AOX	Ptot	Ammonia nitrate	Cu	Zn	Hg	Ni	Cd	Cr(VI)
			m3/year	°C	mg/l	mg/l	ml/l	mg/l	mg/l	mg/l	mg/l	mg/l	mgN/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Year	1997																		
	1997	4	106,800	-	-	-	-	4093	-	-	-	-	-	0	0	0	0	-	0
Year	1996																		
	7. 3.		-	22	5.1	-	-	5500	3350	-	-	-	-	-	-	-	-	-	-
	22. 3.		-		6.5	2294	40	15200	9000	-	-	-	-	-	-	-	-	-	-
	13. 4.		-	24	5.3	921	1	7920	5400	-	-	-	-	-	-	-	-	-	-
	6. 7.		-	27	7.3	1108	1	10700	8200	-	-	-	-	-	-	-	-	-	-
	-		-	16	7.3	1100	0.8	8640	7350	-	-	-	-	-	-	-	-	-	-
	21. 11.		-	15	6.5	702	1	5880	2450	-	-	-	-	-	-	-	-	-	-
	1996	6	105,499	20.8	6.3	1225.0	8.8	8973.3	5958.3	-	-	-	-	-	-	-	-	-	-
Year	1995																		
I	1.9.-31.12.	1	29,500	-	-	-	-	1900	-	-	-	-	-	-	-	-	-	-	-
II	1.9.-31.12.	1	29,600	-	-	-	-	350	-	-	-	-	-	-	-	-	-	-	-

Agricultural Hot Spots

Farm Ihan

Date	No. of samp.	Q	T	pH	Undiss. Matter	Susp. solids	COD	BOD5	Toxicity	AOX	Ptot	Phenols	Ammonia nitrate	Cu	Zn	Fe	Ni	Pb	Cr tot	Sulphate
		m^3/h(year)	°C		mg/l	ml/l	mg/l	mg/l	Sd	mg/l	mg/l	mg/l	mgN/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mgSO4/l
Year	1997																			
26. 5.		14.5	34	8.4	5492	150	7140.0	2100.0	12	-	62.3	-	1564	3.2	11.5	3.2	<0.15	0.17	0.066	-
21. 7.		11.0	30	8.4	4657	155	5733.0	875.0	6	-	240.8	1.73	1129	2.9	6.80	3.4	0.06	0.03	0.032	-
10. 9.		11.0	33	8.3	7294	250	11145.0	3500.0	15	-	85.2	2.9	1336	3.3	7.90	3.7	0.08	<0.1	0.074	-
22. 10.		14.7	30	8.3	8230	350	9100.0	2000.0	30	0.59	73.2	1.23	1422	4.6	13.3	8.8	-	-	-	75
1997	4	82,960	-	8.4	6418.3	226.25	8279.5	2118.8	15.8	-	115.4	1.95	1362.75	3.5	9.89	4.8	-	-	0.06	-
Year	1996				TSS	VSS			N-Kj	NH4-N										
					kg/m^3	kg/m^3			mg/l	mg/l										
Jan		42.29	-	7.47	23.67	16.93	21775.0	9916.7	2097.3	1398.3	-	-	-	-	-	-	-	-	-	-
Feb		42.29	-	7.37	26.33	19.37	23258.3	8611.7	1915.0	1238.0	-	-	-	-	-	-	-	-	-	-
Mar		42.29	-	7.40	24.00	17.43	22348.3	9170.0	1675.3	1189.7	-	-	-	-	-	-	-	-	-	-
Apr		42.29	-	7.63	28.00	21.33	26968.3	11738.0	2072.0	1406.3	-	-	-	-	-	-	-	-	-	-
May		42.29	-	8.30	26.33	19.30	22625.0	7550.0	1709.7	1064.7	-	-	-	-	-	-	-	-	-	-
Jun		42.29	-	7.27	27.00	20.43	24443.3	10078.0	2032.3	1241.3	-	-	-	-	-	-	-	-	-	-
1996		95,800	-	7.57	25.89	19.13	23569.7	9510.7	1916.9	1256.4	-	-	-	-	-	-	-	-	-	-
Year	1995				SS	OS														
					%	%														
6. 10.		-	-	7.58	1.38	56.83	15298.3	-	-	-	-	-	-	-	-	-	-	-	-	-
26. 10.		-	-	7.73	1.03	55.77	13973.3	-	-	-	-	-	-	-	-	-	-	-	-	-
13. 11.		-	-	7.65	1.41	43.90	17096.7	-	-	-	-	-	-	-	-	-	-	-	-	-
8. 12.		-	-	7.56	1.02	53.43	14141.7	-	-	-	-	-	-	-	-	-	-	-	-	-
11. 12.		-	-	7.77	1.68	50.70	14803.3	-	-	-	-	-	-	-	-	-	-	-	-	-
1.9.-31.12.	5	40,000	-	7.66	1.30	52.13	15062.7	-	-	-	-	-	-	-	-	-	-	-	-	-

Farm Ižakovci - Rakičan

Efflu.	Date	No. of sampl.	Q	T	pH	Undissolved matter	Suspended solids	COD	BOD5	TOC	AOX	Ptot	Organic N	Ammonia nitrate	Cu	Zn	Fe	Ni	Pb	Cr(VI)	Cr tot
			m^3/h(year)	°C		mg/l	ml/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mgN/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Year	1997																				
	10. 7.		47.3	-	7.58	2984	31	5896	1899	-	-	145	-	-	2.7	9.6	13	-	-	-	-
	28. 10.		43.7	-	7.83	1600	11.4	3806	1550	-	-	45.5	-	-	1.5	<0.05	0.1	-	-	-	-
	27.11.		41.7	-	7.48	3444	43.2	3670	2925	-	-	81	-	-	2.5	6.5	0.1	-	-	-	-
	15. 12.		53.7	-	7.5	124	2.1	4495	1130	-	-	5.4	-	-	1.4	5	0.1	-	-	-	-
	1997	4	255,500	-	7.6	1944	20.8	4505	1825	-	-	80	-	-	2	-	3.4	-	-	-	-
Year	1996																				
	19. 6.		-	17.5	7.7	7210	68	13958	4283	-	-	-	378	1370	-	-	-	-	-	-	-
	14. 8.		-	22.5	7.9	2020	16	3990	1083	-	-	-	224	707	-	-	-	-	-	-	-
	25. 10.		-	14.5	7.8	2540	18	4348	878	-	-	-	318	767	-	-	-	-	-	-	-
	17. 12.		-	9	7.3	4820	89	7831	2408	-	-	-	295	858	-	-	-	-	-	-	-
	1996	4	255,000	-	7.7	4147.5	47.8	7531.8	2163.0	-	-	-	303.8	925.5	-	-	-	-	-	-	-

Farm Podgrad

Effluent	Date	No. of samplings	Q	T	pH	Undissolved matter	Suspended solids	COD	BOD5	Ptot	Organic N	Ammonia nitrate	Cu	Zn	Fe	Ni	Pb	Cr(VI)	Cr tot
			m^3/h(year)	°C		mg/l	ml/l	mg/l	mg/l	mg/l	mg/l	mgN/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Year	1997																		
	10. 7.		10.6	-	8.16	141	<0.1	327	54	6.05	-	149	0.11	0.34	0.55	-	-	-	-
	28. 10.		6.3	-	8.04	40	<0.1	522	211	5.24	-	193	0.06	0.32	0.1	-	-	-	-
	27. 11.		7.1	-	7.97	700	<0.05	2099	1060	10	-	484	0.26	1.2	0.1	-	-	-	-
	1997	3	48,792	-	8.06	280	<0.1	902	393	7	-	260	0.14	0.59	0.3	-	-	-	-
Year	1996																		
	24. 4.		-	13	7.8	430	<0.05	2504	1712	-	72.1	509	-	-	-	-	-	-	-
	19. 6.		-	17	7.9	343	<0.05	638	195	-	24.5	206.4	-	-	-	-	-	-	-
	14. 8.		-	23	7.8	520	0.3	1168	320	-	46	273	-	-	-	-	-	-	-
	17. 12.		-	9.3	7.8	148	<0.1	470	121	-	21	137	-	-	-	-	-	-	-
	1996	4	25,200	-	7.8	360.3	-	1195.0	587.0	-	40.9	281.4	-	-	-	-	-	-	-
Year	1995																		
	28. 11.		-	9.5	7.5	334	<0.05	415	152	-	10.38	65.9	-	-	-	-	-	-	-
	13. 12.		-	10	7.7	1200	<0.05	4006	1160	-	77.9	63.9	-	-	-	-	-	-	-
	1. 9.-31. 12.	2	16,100	-	7.6	767.0	<0.05	2210.5	656.0	-	44.1	64.9	-	-	-	-	-	-	-

Municipal Hot Spots

Wastewater Treatment Plant -Murska Sobota

Effluent	Date	No. of samplings	Q	T	pH	Undissolved matter	Suspend. solids	COD	BOD5	Suspended matter	Susspended organic m.	Ptot	Ntot	Ammonia nitrate	Dried matter	Fixed solids	Volatile solids
			m^3/year	°C		mg/l	ml/l	mg/l	mg/l			mg/l	mg/l	mgN/l	mg/l	mg/l	mg/l
Year	1997																
	4. 8.		218.2	-	7.8	30	<0.1	57	14	-	-	1.8	-	7	-	-	-
	28. 8.		136.3	-	7.7	120	1.7	170	15	-	-	0.9	-	<1	-	-	-
	26. 9.		177.9	-	7.7	280	30	220	130	-	-	3.2	-	11	-	-	-
	29. 10.		141.0	-	8	34	<0.1	30	20	-	-	0.3	-	12	-	-	-
	4. 12.		210.5	-	7.8	20	<0.1	40	20	-	-	1.9	-	14	-	-	-
	1997	5	1,787,000	-	7.8	96.8	-	103.4	39.8	-	-	1.62	-	-	-	-	-
Year	1996																
	6. 3.		-	-	7.9	30	<0.1	24	<5	630	360	0.44	-	-	-	-	-
	20. 6.		-	-	7.3	60	<0.1	14	<5	530	400	0.5	-	-	-	-	-
	10. 12.		-	-	7.2	<10	<0.1	17.4	3.8	395	372	1.6	-	-	-	-	-
	1996	3	-	-	7.5	-	-	18.5	-	518.3	377.3	0.8	-	-	-	-	-

Wastewater Treatment Plant Rogaška Slatina

Effluent	Date	No. of sampl.	Q	T	pH	Undissolved matter	Suspend. solids	COD	BOD5	Suspended matter	NH3	Ptot	Ntot	Ammonia nitrate	Dried matter	Fixed solids	Volatile solids	Nitrates	Nitrites
			m3/year	°C		mg/l	ml/l	mg/l	mg/l	ml/l	mg/l	mg/l	mg/l	mgN/l	mg/l	mg/l	mg/l	mg/l	mg/l
Year	1996																		
	17. 4.			-	7.76	24	0.1	22	7	404	0.4	-	-	19.6	5.4	-	-	-	0.16
	10. 7.			-	7.79	45	0.6	104	6	413	0.8	-	-	30.6	0.9	-	-	-	0.01
	1996	2	80,000	-	7.775	34.5	0.35	63	6.5	408.5	0.6	-	-	25.1	3.15	-	-	-	0.085

Wastewater Treatment Plant Brežice

Effluent	Date	No. of samplings	Q	T	pH	Undissolved matter	Suspend. solids	COD	BOD5	Ptot	Ntot	Ammonia nitrate	Dried matter	Fixed solids	Volatile solids	Nitrates	Nitrites	Ortopho-sphates
			m^3/yea.	°C		mg/l	ml/l	mg/l	mg/l	mg/l	mg/l	mgN/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Year	1997																	
	5. 11.		-	-	7.5	114	-	370	205	3.4	38.4	29.1	-	-	-	-	-	-
	1997	1	447,000	-	7.5	114	-	370	205	3.4	38.4	29.1	-	-	-	-	-	-

Wastewater Treatment Plant "MAJER" Črnomelj

Effluent	Date	No. of samplings	Q	T	pH	Undissolved matter	Suspen. solids	COD	BOD5	Ptot	Ntot	Ammonia nitrate	Dried matter	Fixed solids	Volatile solids	Nitrates	Nitrites	Ortopho-sphates
			m3/year	°C		mg/l	ml/l	mg/l	mg/l	mg/l	mg/l	mgN/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Year	1997																	
	27. 8.			-	7.6	618	-	1070	415	9.6	-	12.6	-	-	-	-	-	-
	21. 11.			-	7.5	884	-	630	270	5.4	-	3.4	-	-	-	-	-	-
	1997	2	49,700	-	7.6	751.0	-	850.0	342.5	7.5	-	8.0	-	-	-	-	-	-
Year	1996																	
	25. 1.			8.4	-	-	-	86.0	30.0	-	-	0.07	-	-	-	-	-	-
	19. 2.			21.1	-	-	-	44.0	10.0	-	-	0.13	-	-	-	-	-	-
	19 .3.			13.1	-	-	-	39.0	12.0	-	-	0.04	-	-	-	-	-	-
	23. 4.			10.8	-	-	-	31.0	18.5	-	-	1.46	-	-	-	-	-	-
	21. 5.			18.3	-	-	-	54.0	20.0	-	-	13.80	-	-	-	-	-	-
	17. 6.			18.7	-	-	-	37.0	11.0	-	-	10.20	-	-	-	-	-	-
	30. 7.			20.7	-	-	-	264.0	140.0	-	-	12.70	-	-	-	-	-	-
	21. 8.			21.5	7.7	410	40	780	400	0.2	-	18.60	-	-	-	-	-	-
	17. 12.			7	8.1	33	<0.1	109	90	0.1	-	9.50	-	-	-	-	-	-
	1996	9	36,000	15.5	7.9	221.5	-	160.4	81.3	0.15	-	7.4	-	-	-	-	-	-

Wastewater Treatment Plant Črnomelj (Emšer)

Effluent	Date	No. of samplings	Q	T	pH	Undissolved matter	Suspend. solids	COD	BOD5	Ptot	Ntot	Ammonia nitrate	Dried matter	Fixed solids	Volatile solids	Nitrates	Nitrites	Ortopho-sphates
			m^3/year	°C		mg/l	ml/l	mg/l	mg/l	mg/l	mg/l	mgN/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Year	1997																	
	9 .7.			-		116	-	344	190	4.2	-	32	-	-	-	-	-	-
	17. 12.			-	7.1	114	-	480	264	4.2	58.3	44.4	-	-	-	-	-	-
	1997		27,500	-	7.1	114	-	480	264	4.2	58.3	44.4	-	-	-	-	-	-
Year	1996																	
	19. 2.			6.2	7.3	223	-	405	210	-	-	-	-	-	-	-	-	-
	21. 5.			15.4	7.1	113	-	328	210	-	-	-	-	-	-	-	-	-
	21. 8.			19.7	7.2	159	0.3	475	295	0.1	-	26.4	-	-	-	-	-	-
	17. 12.			9	7.4	96	<0.1	392	240	0.1	-	37	-	-	-	-	-	-
	1996	4	22,000	12.575	7.25	147.75	-	400	238.75	0.1	-	31.7	-	-	-	-	-	-

Wastewater Treatment Plant Črnomelj (Vojna vas)

Effluent	Date	No. of samplin.	Q	T	pH	Undissolved matter	Suspend. solids	COD	BOD5	Ptot	Ntot	Ammonia nitrate	Dried matter	Fixed solids	Volatile solids	Nitrates	Nitrites	Ortopho-sphates
			m^3/h	°C		mg/l	ml/l	mg/l	mg/l	mg/l	mg/l	mgN/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Year	1997																	
	16. 5.		83.1	-	7.8	2.4	-	25	<5	2.1		<0.2	-	-	-	1.4	0.52	-
	9 .7.		94.6	-	-	6	<0.1	18	3	3.7	5	<0.1	-	-	-	0.6	<0.01	-
	25. 9.		137.0	19.4	8.3	2.4	-	29	6	4.7	16	1	-	-	-	14	0.38	-
	18. 12.		108.2	-	7.4	32	-	34	<10	4.5	28	0.2	-	-	-	-	-	-
	1997	4	105.7	-	7.8	10.7	-	26.5	-	3.75	16.3	-	-	-	-	-	-	-

Wastewater Treatment Plant

Effluent	Date	No. of samplings	Q	T	pH	Undissolved matter	Suspend. solids	COD	BOD5	Ptot	Ntot	Ammonia nitrate	Dried matter	Fixed solids	Volatile solids	Nitrat.	Nitrit.	Ortopho-sphates
			m^3/year	°C		mg/l	ml/l	mg/l	mg/l	mg/l	mg/l	mgN/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Year	1997																	
	16. 5.			-	7.6	80	-	291	105	6.2	-	5.6	-	-	-	-	-	-
	10. 7.			23.4	8.3	82	-	163	98	2.8	-	<0.1	-	-	-	-	-	-
	25. 9.			19.6	7.7	97	-	300	83	2.5	-	9.3	-	-	-	-	-	-
	18. 12.			-	8.4	109	-	380	160	3.2	20.2	8.4	-	-	-	-	-	-
	1997	4	766,506	21.5	8	92	-	283.5	111.5	3.675	20.2	7.8	-	-	-	-	-	-
Year	1996																	
	25. 11.			13.2	7.9	-	0.7	282	80	-	-	-	-	628	188	-	-	-
	19. 2.			8.2	7.6	-	0.7	216	90	-	-	-	-	276	226	-	-	-
	18. 3.			15.8	7.7	-	1	462	230	-	-	-	-	403	395	-	-	-
	23. 4.			10.9	7.6	-	0.6	366	190	-	-	-	-	505	310	-	-	-
	30. 5.			21.1	7.5	-	3	280	105	-	-	-	-	523	265	-	-	-
	18. 6.			21.2	7.9	-	0.4	330	150	-	-	-	-	510	687	-	-	-
	1. 8.			19	7.5	-	0.1	230	120	-	-	-	-	362	255	-	-	-
	21. 8.			25.8	7.7	-	0.4	304	100	0.1	-	15.5	-	-	-	-	-	-
	30. 9.			20.2	7.6	-	-	277	110	-	-	-	-	-	-	-	-	-
	7. 11.			-	-	-	-	300	100	0.2	-	2.6	-	-	-	-	-	-
	1996	10	766,506	17.3	7.7	-	0.9	304.7	127.5	0.15	-	9.05	-	458.1	332.3	-	-	-

Wastewater Treatment Plant Novo mesto

Effluent	Date	No. of samplings	Q	T	pH	Undissolved matter	Suspen. solids	COD	BOD5	Ptot	Ntot	Ammonia nitrate	Dried matter	Fixed solids	Volatile solids	Nitrates	Nitrites	Ortopho-sphates
			m^3/h(year)	°C		mg/l	ml/l	mg/l	mg/l	mg/l	mg/l	mgN/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Year	1997																	
	25. 2.		179.8	<30	7.8	94	<0.5	314	100	-	-	-	-	-	-	-	-	-
	25. 3.		159.2	12.6	7.9	53	<0.5	202	85	-	-	-	-	-	-	-	-	-
	-		168.2	<30	7.8	54	<0.5	265	120	-	-	-	-	-	-	-	-	-
	4. 6.		191.0	<30	7.9	88	<0.5	236	85	-	-	-	-	-	-	-	-	-
	-		167.1	<30	8.0	26	<0.5	140	70	-	-	-	-	-	-	-	-	-
	-		160.8	20	8.1	69	<0.5	95	18	-	-	-	-	-	-	-	-	-
	-		163.5	<30	8.0	25	<0.5	65	20	-	-	-	-	-	-	-	-	-
	-		166.0	<30	7.8	88	<0.5	342	135	-	-	-	-	-	-	-	-	-
	1997	8	1,499,000	<30	7.9	62.1	<0.5	207.4	79.1	-	-	-	-	-	-	-	-	-

Wastewater Treatment Plant -Vrhnika

Effluent	Date	No. of samplings	Q	T	pH	Undissolved matter	Suspend. solids	COD	BOD5	Ptot	Ntot	Ammonia nitrate	Dried matter	Fixed solids	Volatile solids	Nitrates	Nitrites	Ortopho-sphates
			m^3/year	°C		mg/l	ml/l	mg/l	mg/l	mg/l	mg/l	mgN/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Year	1997																	
	7. 10.			18	8	240	1	1183	640	5.9	-	195	-	-	-	-	-	-
	15. 12.			9.8	8.1	96.5	1.4	888	560	2.66	-	214.6	-	-	-	-	-	-
	1997	2	66,795	13.9	8.05	168.25	1.2	1035.5	600	4.28	-	204.8	-	-	-	-	-	-

Wastewater Treatment Plant Velenje

Effluent	Date	No. of samplings	Q	T	pH	Undissolved matter	Suspen. solids	COD	BOD5	Ptot	Ntot	Ammonia nitrate	Dried matter	Fixed solids	Volatile solids	Nitrates	Nitrites	Ortopho-sphates
			m^3/h(year)	°C		mg/l	ml/l	mg/l	mg/l	mg/l	mg/l	mgN/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Year	1997																	
	22. 1.		950.8	-	-	70	-	103	68	-	-	7.8	607	512	94	8.1	7.23	2.6
	25. 2.		700.4	-	-	51	-	149	50	-	-	16.8	474	361	113	0.4	0.17	3.7
	29. 4.		554.0	-	-	101	-	194	90	-	34.4	23.8	503	328	175	0.2	0.004	5
	27. 5.		562.5	-	-	27	-	138	62	-	22.5	16	237	178	59	0	0.041	4.1
	12. 8.		475.4	-	-	90	-	134	60	-	27.5	18.7	476	367	109	0.2	0.091	1.6
	7. 10.		528.8	-	-	77	-	184	80	-	24.9	14.3	507	403	104	1	0.186	2.1
	19. 11.		635.0	-	-	56	-	139	78	-	19.47	17	449	390	59	4.4	0.39	1.9
	16. 12.		717.1	-	-	48	-	107	45	-	20.4	16	451	371	86	1.9	1.02	1.4
	1997	8	5,839,000	-	-	65	-	143.5	66.6	-	24.9	16.3	463.0	363.8	99.9	2.0	1.12	2.8
Year	1996																	
	14. 3.		1387.5	-	-	57	-	155.0	53.0	-	17.6	16.0	713.0	611.0	102.0	0.9000	1.0200	3.4000
	10. 4.		1303.3	-	-	39	-	106.0	57.0	-	18.9	15.8	443.0	365.0	72.0	0.0100	0.1700	3.2000
	14. 6.		899.6	-	-	53	-	100.0	104.0	-	26.6	12.1	460.0	373.0	87.0	2.4000	0.9100	4.3000
	28. 8.		619.6	-	-	44	-	141.0	61.0	-	21.4	17.2	337.0	264.0	73.0	0.1000	0.0090	3.9000
	11. 9.		471.7	-	-	84	-	213.0	103.0	-	26.2	21.4	450.0	382.0	68.0	0.2000	0.0040	5.8000
	30. 10.		505.8	-	-	97	-	188.0	157.0	-	31.6	21.7	530.0	400.0	131.0	0.1000	0.0040	5.4000
	26. 11.		571.3	-	-	30	-	119.0	65.0	-		16.7	498.0	386.0	112.0	0.0450	0.0000	2.7000
	5. 12.		589.2	-	-	67	-	148	79	-	19.7	16.9	454	454	105	1.7500	0.0490	0.6200
	1996	8	-	-	-	58.9	-	146.3	84.9	-	23.1	17.2	485.6	404.4	93.8	0.73	0.34	3.72

Annex 4.1.-1

Index of Water Quality and Discharge Records

The fraction values indicate the counter the number of years of continuous measurements, the denominator the last year of the measurement period. Numbers in parenthesis indicate the last year for which the data are checked and officially approved (and made available). E.g. 25/98(96) means that there are 25 years of continuous measurements up to the year 1998, but the last data elaborated are from the year 1996.

River Name		Sampling Station	River Bank	Coordinates		Number of Years of Records and the Latest Year of Record for Each of the Following Categories of Parameters						
				φ	λ	Water Discharge	Sediment Discharge	N	P	BOD or COD	Heavy Metals	Other Toxics
MURA	D	PETANJCI		46o38'56"	16o03'33"	42/98 (96)	NR					
	Q	PETANJCI	L	46o38'59"	16o03'20"			35/98 (97)	35/98 (97)	35/98 (97)	NR	NR
Š•AVNICA	D	PRISTAVA I		46o38'06"	16o14'16"	25/98 (96)	NR					
	Q	PRISTAVA	L	46o31'08"	16o14'12"			35/98 (97)	35/98 (97)	35/98 (97)	NR	NR
LEDAVA		•ENTIBA	R	46o32'06"	16o29'00"	29/98 (96)	NR	18/98 (97)	18/98 (97)	18/98 (97)	NR	NR
DRAVA	D	BORL		46o22'17"	16o00'04"	45/98 (96)	NR					
	Q	BORL	R	46o22'19"	16o00'07"			33/98 (97)	33/98 (97)	33/98 (97)	NR	NR
DRAVA	D	HE DRAVOGRAD		46o35'13"	15o01'25"	35/98 (96)						
	Q	DRAVOGRAD	L	46o35'20"	15o01'48"		35/98 (95)	35/98 (97)	35/98 (97)	35/98 (97)	NR	12/98 (97)
DRAVA	D	ORMOZ		*	*	*	*					
	Q	ORMOZ	M	46o24'12"	16o09'36"			32/98 (97)	32/98 (97)	32/98 (97)	12/98 (95)	12/98 (97)
ME•A	D	OTIŠKI VRH I		46o34'40"	15o01'49"	45/98 (96)	NR					
	Q	OTIŠKI VRH	R	46o34'58"	15o01'32"			35/98 (97)	35/98 (97)	35/98 (97)	NR	NR
MISLINJA		OTIŠKI VRH	R	46o34'04"	15o02'32"	25/98 (96)	NR	35/98 (97)	35/98 (97)	35/98 (97)	NR	NR
DRAVINJA	D	VIDEM I		46o22'01"	15o54'24"	26/98 (96)	NR					
	Q	VIDEM	R	46o22'07"	15o54'29"			22/98 (97)	22/98 (97)	22/98 (97)	NR	NR
PESNICA	D	ZAMUŠANI I		46o24'55"	16o02'07"	37/98 (96)	NR					
	Q	ZAMUŠANI	L	46o24'50"	16o02'23"			21/98 (97)	21/98 (97)	21/98 (97)	NR	NR
SAVA DOLINKA	D	KRANJSKA GORA		46o29'21"	13o47'47"	8/98 (95)	NR					
	Q	PODKOREN	R	46o29'29"	13o45'28"			16/98 (97)	16/98 (97)	16/98 (97)	NR	NR
SAVA DOLINKA		BLEJSKI MOST	L	46o22'04"	14o08'21"	39/98 (95)	NR	24/98 (97)	24/98 (97)	24/98 (97)	NR	NR
SAVA BOHINJKA		SVETI JANEZ	M	46o16'43"	13o53'28"	47/98 (95)	NR	35/98 (97)	35/98 (97)	35/98 (97)	NR	NR
SAVA BOHINJKA		BODEŠ•E	R	46o20'32"	14o08'48"	48/98 (95)	NR	35/98 (97)	35/98 (97)	35/98 (97)	NR	NR
SAVA	D	MEDNO		46o07'20"	14o26'44"	30/98 (95)	NR					
	Q	MEDNO	R	46o07'09"	14o27'12"			22/98 (97)	22/98 (97)	22/98 (97)	12/98 (95)	12/98 (97)
SAVA		LITIJA	R	46o03'21"	14o49'39"	45/98 (95)	NR	35/98 (97)	35/98 (97)	35/98 (97)	NR	NR

*...Borl+HE Formin+Jez Markovci=Ormo•

River Name		Sampling Station	River Bank	Coordinates		Number of Years of Records and the Latest Year of Record for Each of the Following Categories of Parameters						
				φ	λ	Water Discharge	Sediment Discharge	N	P	BOD or COD	Heavy Metals	Other Toxics
SAVA	D	RADE•E		**	**	89/98 (95)	NR					
	Q	RADE•E	R	46o13'52"	15o11'22"			35/98 (97)	35/98 (97)	35/98 (97)	NR	12/98 (97)
SAVA	D	•ATE• I		45o53'36"	15o36'52"	52/98 (95)	NR					
	Q	JESENICE	R	45o51'41"	15o41'48"			16/98 (97)	16/98 (97)	16/98 (97)	12/98 (95)	12/98 (97)
KOKRA		KRANJ	R	46o1' 36"	14o22'38"	12/98 (95)	NR	35/98 (97)	35/98 (97)	35/98 (97)	NR	12/98 (96)
SORA		MEDVODE	R	46o08'22"	14o2' 08"	10/98 (95)	NR	12/98 (97)	12/98 (97)	12/98 (97)	NR	12/98 (96)
KAMNIŠKA BIST.	D	VIR		46o08'54"	14o36'31"	20/98 (95)	NR					
	Q	BERI•EVO	R	46o05'21"	14o37'49"			35/98 (97)	35/98 (97)	35/98 (97)	NR	12/98 (94)
MIRNA	D	JELOVEC !		45o59'20"	15o14'06"	7/98 (95)	NR					
	Q	BOŠTANJ	L	46o00'29"	15o17'52"			22/98 (97)	22/98 (97)	22/98 (97)	NR	NR
SOTLA		RAKOVEC	R	45o55'16"	15o42'36"	33/98 (96)	NR	20/98 (97)	20/98 (97)	20/98 (97)	NR	NR
KOLPA		PETRINA	L	45o37'34"	14o51'25"	46/98 (96)	NR	32/98 (97)	32/98 (97)	32/98 (97)	NR	NR
KOLPA	D	METLIKA		45o38'04"	15o19'39"	46/98 (96)	NR					
	Q	METLIKA	L	45o38'03"	15o19'30"			26/98 (97)	26/98 (97)	26/98 (97)	12/98 (95)	12/98 (97)
LJUBLJANICA	D	MOSTE		46o03'15"	14o33'14"	46/98 (95)	NR					
	Q	LIVADA ?	R	46o02'09"	14o30'48"			21/98 (95)	21/98 (97)	21/98 (97)	NR	NR
LJUBLJANICA	D	MOSTE		46o03'15"	14o33'14"	46/98 (95)	NR					
	Q	ZALOG ?	R	46o04'20"	14o38'22"			22/98 (97)	22/98 (97)	22/98 (97)	12/98 (95)	12/98 (95)
SAVINJA	D	LETUŠ I		46o19'36"	15o00'33"	4/98 (96)	NR					
	Q	LETUŠ	L	46o18'58"	15o01'35"			32/98 (97)	32/98 (97)	32/98 (97)	NR	NR
SAVINJA		VELIKO ŠIRJE I	R	46o05'33"	15o11'52"	31/98 (96)		35/98 (97)	35/98 (97)	35/98 (97)	12/98 (95)	12/98 (97)
PAKA		RE•ICA	R	46o19'17"	15o02'36"	26/98 (96)	NR	21/98 (97)	21/98 (97)	21/98 (97)	NR	NR
VOGLAJNA	D	CELJE II		46o13'56"	15o17'12"	32/98 (96)	NR					
	Q	CELJE	L	46o13'18"	15o16'21"			34/98 (97)	34/98 (97)	34/98 (97)	NR	NR
KRKA		PODBUKOVJE	R	45o52'38"	14o47'27"	39/98 (95)	NR	21/98 (97)	21/98 (97)	21/98 (97)	NR	NR
KRKA		GORNJA GOMILA	R	45o5' 04"	15o17'26"	36/98 (95)	NR	21/98 (97)	21/98 (97)	21/98 (97)	NR	NR

!….Calculated data ?…Estimated discharge **...Veliko Širje+Hrastnik=Radeče

Annex 4.1.-2

List of Gauging Stations with over 5 Years Observation Period

Preglednica 1: Seznam vodomernih postaj z nad pet letnim delovanjem
Table 1: Gauging stations with over five years observation period

VODOMERNA POSTAJA gauging station	VODOTOK stream	POVRŠINA catchmant area	KOORDINATE coordinates		KOTA "0" point (m.n.m.)	OPAZOVANJA observations		
		F (km²)	X	Y		ZAČ. begin	KON. end	ŠT.LET years
POMURJE								
CMUREK	MURA	9796.4	560790	174230		1956	1981	
VIZJAKOV KANAL	MURA					1957	1966	
II.MLINSKI KANAL	MURA					1957	1967	
ČRNCI	MURA					1960	1966	
GORNJA RADGONA I	MURA	10197*	576530	171280	202.338	1930		68
PETANJCI	MURA	10391.44	581070	167710	193.763	1956		42
VERŽEJ	MURA		590691	161207		1954	1964	
PETIŠOVCI	MURA		611103	153289		1956	1962	
CANKOVA	KUČNICA	30.4	578460	174610	206.143	1961		37
ZGORNJA ŠČAVNICA	ŠČAVNICA	16.31	564520	168560		1969	1982	
IVANJŠEVCI	ŠČAVNICA	56.31	573790	164480		1968	1988	
ŽIHLAVA	ŠČAVNICA		580640	157015		1959	1971	
PRISTAVA	ŠČAVNICA				170.402	1939	1974	
PRISTAVA I	ŠČAVNICA	272.54	594960	153410	169.768	1973		25
BRANISLAVCI	TURJA	42.17	586550	154520		1961	1989	
SOTINA	LEDAVA	46.75	578550	187030		1981	1992	
NUSKOVA	LEDAVA	50.61	578800	185620	232.149	1993		5
PERTOČA I	LEDAVA					1956	1963	
DOMAJINCI	LEDAVA	108.29	579870	179120		1969	1986	
POLANA	LEDAVA					1956	1966	
POLANA I	LEDAVA	208.21	587450	171000	191.399	1962		36
MURSKA SOBOTA	LEDAVA					1954	1978	
DOLNJA LENDAVA	LEDAVA					1954	1970	
ČENTIBA	LEDAVA	856.7	613770	155590	154.67	1969		29
DOLNJI SLAVEČI	LUKAJ POTOK		581380	182731		1959	1971	
KRAŠCE	ČRNEC					1967	1975	
MAČKOVCI	MAČKOVSKI POTOK		589301	183498		1967	1975	
MARTJANCI	MARTJANSKI POTOK	28.11	591060	171970	189.34	1970		28
KOBILJE	KOBILJSKI POTOK	48.66	606640	172570	183.81	1972		26
MOSTJE	KOBILJSKI POTOK	244.8	610130	162150	158.23	1975	1994	
DOLNJA LENDAVA	KOBILJSKI POTOK					1954	1971	
SREDIŠČE	IVANJŠEVSKI POTOK	8.24	600640	181520		1985		13
DOLNJA LENDAVA	ČRNI POTOK					1954	1971	
HODOŠ	VELIKA KRKA	105.12	601460	186730	225.385	1959		39
PODRAVJE								
VUHRED	DRAVA					1954	1965	
FALA I	DRAVA					1975	1982	
MARIBOR	DRAVA					1926	1965	
PTUJ	DRAVA	13664.1			216.81	1938	1982	
BORL	DRAVA	14661.5	577020	136810	201.486	1953		45
ORMOŽ KOPALIŠČE	DRAVA					1966	1972	
ORMOŽ	DRAVA	15378.8			186.04	1962	1981	
TOPLA	MEŽA	50.51	485300	146950	559.81	1954	1982	
ČRNA	MEŽA	94.77	488710	147370	573.416	1970		28
PODKLANC	MEŽA					1954	1974	
PODKLANC I	MEŽA	309.54	501470	158390		1973	1989	
OTIŠKI VRH I	MEŽA	550.89	502330	159260	333.966	1953		45
TOPLA	TOPLA	13.6				1954	1968	
PRISTAVA	BISTRA					1954	1962	
JAVORJE	JAVORSKI POTOK					1954	1964	
ČRNA	JAVORSKI POTOK	32.17	488970	147310		1970	1982	
ŽERJAV	JAZBINA	24.1	491950	148940	530	1954	1972	
POLJANA	JAMNIŠKI POTOK	23.44	492230	156060		1973	1982	
MISLINJA	MISLINJA	27.62	519120	146590	640	1956	1982	
DOVŽE	MISLINJA					1946	1968	
DOVŽE I	MISLINJA	72.29	511980	145640	517.389	1970		28
SLOVENJ GRADEC	MISLINJA	183.86	506900	153080		1954	1982	
OTIŠKI VRH I	MISLINJA	230.89	503240	158150	344.735	1973		25
OTIŠKI VRH	MISLINJA					1954	1973	
PODGORJE	SUHADOLNICA	43.45	507070	148250		1974	1982	
STARI TRG	SUHADOLNICA					1968	1988	

VODOMERNA POSTAJA gauging station	VODOTOK stream	POVRŠINA catchmant area	KOORDINATE coordinates		KOTA "0" point (m.n.m.)	OPAZOVANJA observations		
		F (km²)	X	Y		ZAČ. begin	KON. end	ŠT.LET years
STARI TRG I	SUHADOLNICA	59.21	505950	151950	404.853	1980		18
MUTA	BISTRICA	146.55	512900	163110	326.116	1948		50
HUDI KOT	VUHREDŠČICA					1954	1966	
ORLICA	VUHREDŠČICA					1967	1982	
LEHEN	VELKA	46.69	525130	157220	416.89	1958	1982	
PESEK	RADOLJNA	4.69	526020	148020		1953	1966	
RUTA	RADOLJNA	74.14	532840	157270	298.945	1972		26
ŠUMIK	LOBNICA		534610	148660		1953	1966	
RUŠE	LOBNICA	42.56	538080	154610	276.822	1955	1982	
ZREČE	DRAVINJA	41.43	529720	137510	305.723	1972		26
DRAŽA VAS	DRAVINJA	169.57	538200	130860		1977	1991	
LOČE	DRAVINJA	175.07	538440	128740	276.471	1955		43
POLJČANE	DRAVINJA					1948	1970	
MAKOLE	DRAVINJA	301.52	552000	130820	244.01	1972		26
VIDEM I	DRAVINJA	763.75	569760	136230	210.044	1972		26
VIDEM	DRAVINJA	764	569852	136428	210.044	1946	1971	
HUDI VRH	OPLOTNICA	9.74			1159.09	1954	1982	
DRAŽA VAS	OPLOTNICA	85.53	538330	131410	276.049	1972		26
LAŽE	LIČNICA					1974	1982	
SPODNJA LOŽNICA	LOŽNICA	30.76	542770	137340		1973	1981	
MOČNIK	BISTRICA					1948	1981	
SLOVENSKA BISTRICA	BISTRICA	32.41	544410	139070	271.112	1946	1974	
SLOVENSKA BISTRICA I	BISTRICA	32.41	544410	139070	270.112	1973	1986	
PODLEHNIK	ROGATNICA	57.2	568080	132380	223.449	1974		24
ZGORNJA POLSKAVA	POLSKAVA	35.61	546770	143380		1953	1988	
MEDVEDCE	POLSKAVA					1972	1982	
TRŽEC	POLSKAVA	188.27	567920	135870	214.315	1953		45
BRINJE	DEVINA	16.8	546730	139630		1971	1981	
HOČE	HOČKI POTOK					1967	1982	
SLIVNICA	POLJANŠČICA					1967	1976	
FRAM	FRAMSKI POTOK					1967	1982	
JEDLOVNIK	PESNICA					1975	1982	
RANCA	PESNICA	83.8	552580	161940	250.27	1954		44
ŠMARJETA	PESNICA					1948	1957	
PERNICA	PESNICA					1971	1981	
MUČNO	PRISTAVSKO JEZERO					1969	1982	
GOČOVA	PESNICA	281.14	567080	157280	225.233	1970		28
PACINSKI MOST	PESNICA					1965	1971	
ZAMUŠANI I	PESNICA	477.8	579570	141730	201.856	1961		37
ZAMUŠANI	PESNICA					1946	1959	
LENART	GLOBOVNICA					1971	1982	
LENART	VELKA	43.81	564650	159880		1970	1989	
BRENGOVA	DRVANJA					1971	1982	
PODGORCI	CVETKOVSKI POTOK					1965	1971	
SENEŠCI	SEJANSKI POTOK					1965	1982	
SREDIŠČE OB DRAVI	TRNAVA					1974	1982	
POSAVJE								
PODKOREN	SAVA DOLINKA	30.14	404645	150425	833.609	1958	1991	
KRANJSKA GORA	SAVA DOLINKA	44.98	407610	150130	790.529	1990		8
GOZD MARTULJEK	SAVA DOLINKA					1958	1966	
MOJSTRANA	SAVA DOLINKA					1953	1966	
DOVJE	SAVA DOLINKA	219.83	420570	146840		1972	1989	
JESENICE	SAVA DOLINKA	257.56	427450	143845	566.433	1918		80
BLEJSKI MOST	SAVA DOLINKA	505.4	433785	136305	427.946	1959		39
MOJSTRANA	BISTRICA	46.87	420070	146900		1953	1972	
MOJSTRANA I	BISTRICA					1972	1989	
JAVORNIK	JAVORNIK					1954	1964	
SREDNJA RADOVNA	RADOVNA	58	423260	141020		1952	1982	
FUŽINE	RADOVNA	99.5	425320	138760		1953	1982	
SPODNJA RADOVNA	RADOVNA					1953	1966	
GRABČE	RADOVNA		428040	137850		1964	1982	
PODHOM	RADOVNA	165.6	430060	139240	566.067	1933		65
VINTGAR	RADOVNA					1954	1966	
SVETI JANEZ	SAVA BOHINJKA	93.99	414560	126620	524.948	1951		47
SOTESKA	SAVA BOHINJKA	286.82	426200	128760		1926	1989	
SOTESKA I	SAVA BOHINJKA					1926	1989	

VODOMERNA POSTAJA gauging station	VODOTOK stream	POVRŠINA catchmant area	KOORDINATE coordinates		KOTA "0" point (m.n.m.)	OPAZOVANJA observations		
		F (km²)	X	Y		ZAČ. begin	KON. end	ŠT.LET years
BODEŠČE	SAVA BOHINJKA	354.5	434320	133450	413.897	1950		48
UKANC	SAVICA		409920	127010	528.83	1954		44
SVETI DUH	BOHINJSKO JEZERO	93.99	412900	126720	525.886	1954		44
STARA FUŽINA	MOSTNICA		415170	127740		1950	1958	
STARA FUŽINA II	MOSTNICA	78.11	414790	127140	527.14	1959		38
STARA FUŽINA I	MOSTNICA				527.14	1951	1966	
BOHINJSKA BISTRICA	BISTRICA	KRAS	419430	126030	504.33	1968		30
BOHINJSKA BISTRICA	PREDORSKI POTOK	KRAS				1965	1971	
BLED	BLEJSKO JEZERO		431660	136500		1952	1982	
MLINO	BLEJSKO JEZERO	8.38	431060	135520	474.473	1979		19
ZAKA	BLEJSKO JEZERO					1956	1982	
MLINO I	JEZERNICA	8.61	431020	135150	467.515	1955		43
RADOVLJICA	SAVA					1913	1953	
RADOVLJICA I	SAVA	895.3	436120	133220	408.086	1953		45
MLAKA	SAVA					1965	1971	
GLOBOKO	SAVA					1965	1971	
OKROGLO	SAVA	1201.48	447910	123710	355.939	1986		12
KRANJ	SAVA		450505	121590		1925	1976	
KRANJ I	SAVA					1980	1987	
PREBAČEVO	SAVA		453385	118865		1954	1985	
MAVČIČE	SAVA					1954	1971	
MEDNO	SAVA	2191.43	457175	108815	301.473	1968		30
ŠENTJAKOB	SAVA	2275.6	468075	104515	268.185	1952		46
LITIJA I	SAVA	4821.43	486660	101285	230.444	1953		45
LITIJA	SAVA					1895	1952	
ZAGORJE	SAVA					1954	1975	
TRBOVLJE	SAVA					1965	1971	
HRASTNIK	SAVA	5176.79	507370	108650	195.077	1993		5
RADEČE	SAVA	7083.7	514390	103055	184.142	1909		89
BOŠTANJ	SAVA					1965	1971	
BLANCA	SAVA					1965	1971	
KRŠKO I	SAVA					1952	1981	
BREŽICE	SAVA		546305	83895		1926	1982	
ČATEŽ	SAVA					1926	1976	
ČATEŽ I	SAVA	10149	547685	83400	137.279	1946		52
OVSIŠE I	LIPNICA	55.83	442640	127560	379.99	1955		43
JELENDOL	TRŽIŠKA BISTRICA		449830	139480		1957	1965	
TRŽIČ	TRŽIŠKA BISTRICA		447980	136270		1953	1982	
PRESKA	TRŽIŠKA BISTRICA	121	446530	135160	488.52	1957		41
ZGORNJE DUPLJE	TRŽIŠKA BISTRICA					1926	1967	
PODBREZJE	TRŽIŠKA BISTRICA	141.39	445220	127550		1977	1989	
BISTRICA	KANAL TRŽIŠKE B.		445270	127530		1977	1989	
TRŽIČ I	MOŠENIK					1965	1989	
KOKRA I	KOKRA	112.34	461790	129310	522.847	1956		42
KOKRA	KOKRA					1926	1966	
BRITOF	KOKRA		452990	124300		1954	1982	
BRITOF I	KOKRA					1954	1982	
KRANJ II	KOKRA	220.23	451990	122300	356.952	1986		12
KRANJ	KOKRA					1954	1985	
KRANJ I	KOKRA					1954	1985	
SUHA	SORA					1926	1952	
SUHA I	SORA	566.34	448300	113310	329.47	1953		45
MEDVODE I	SORA	642.86	454710	110930	308.646	1988		10
ŽIRI	POLJANSKA SORA					1949	1987	
ŽIRI II	POLJANSKA SORA	53.68	431490	99630	474.621	1960		38
ŽIRI I	POLJANSKA SORA	54.39				1949	1987	39
ZMINEC	POLJANSKA SORA	305.51	445570	112380	343.313	1954		44
ZMINEC I	POLJANSKA SORA				343.234	1967	1990	
ŽELEZNIKI	SELŠKA SORA	101.34	435690	120090	447.397	1991		7
DOLENJA VAS	SELŠKA SORA	159.95	440280	119010		1954	1970	
DOLENJA VAS I	SELŠKA SORA					1960	1979	
DOLENJA VAS II	SELŠKA SORA	162.24	440350	118960		1979	1988	
VEŠTER	SELŠKA SORA	212.39	445160	114480	358.186	1988		10
ŠKOFJA LOKA	SELŠKA SORA	213.86	446090	114120		1953	1984	
ŠKOFJA LOKA I	SELŠKA SORA					1956	1988	
ZGORNJE GAMELJNE	GAMELJŠČICA		460950	109450		1964	1982	

VODOMERNA POSTAJA gauging station	VODOTOK stream	POVRŠINA catchmant area F (km^2)	KOORDINATE coordinates X	Y	KOTA "0" point (m.n.m.)	OPAZOVANJA observations ZAČ. begin	KON. end	ŠT.LET years
IVERJE	KAMNIŠKA BISTRICA	67.48	470640	126060		1954	1988	
STAHOVICA	KAMNIŠKA BISTRICA					1951	1966	
KAMNIK I	KAMNIŠKA BISTRICA	194.8	470540	120100	370.799	1957		41
KAMNIK	KAMNIŠKA BISTRICA					1926	1956	
KAMNIK	INDUSTRIJSKI KANAL					1956	1975	
VIR	KAMNIŠKA BISTRICA	207.8	469770	111620.	301.203	1978		20
DOMŽALE	KAMNIŠKA BISTRICA	372.83	469730	110520	294.174	1977	1990	
DOMŽALE	MLINŠČICA-KANAL		469410	110500	296.89	1978		20
NEVLJE I	NEVLJICA	82.03	471440	121040	379.94	1956		42
DOB	RAČA					1959	1966	
PODREČJE I	RAČA					1954	1977	
VIR	RAČA	161.13	470706	111153	299.195	1996		2
PODREČJE	RAČA	164.06	470180	110950	297.467	1977		21
TRNJAVA	RADOMLJA					1954	1982	
TRNJAVA I	RADOMLJA Z DRTIŠČICO					1954	1982	
VIR	MLINŠČICA		470340	111620	301.069	1956	1988	
MOSTE	PŠATA	78.19	465440	116680		1956	1988	
TOPOLE	PŠATA	93.79	466620	114490	320.188	1986		12
TRZIN	PŠATA		466392	111118	301.069	1996		2
ZGORNJE JARŠE	RAZBRE. PŠATE					1978	1988	
BREG	REKA		488420	101850		1959	1988	
LOKE	MEDIJA					1959	1966	
ZAGORJE I	MEDIJA	96.85	500090	108820	228.136	1954		44
ŽEBNIK	SOPOTA	48.22	510760	102100	256.704	1959		39
MARTINJA VAS I	MIRNA	164.48	510900	90700	228.92	1963		35
MARTINJA VAS	MIRNA					1954	1962	
GABRJE	MIRNA					1954	1990	
GABRJE I	MIRNA	267.74	516980	93700	212.127	1954	1990	
JELOVEC	MIRNA	270	518200	93850	208.935	1991		7
OREŠJE	SEVNIČNA	39.71	523215	99253	221.826	1994		4
ROGATEC	SOTLA	39.5	554340	120120		1949	1989	
RAKOVEC I	SOTLA	557.7	555070	86540	139.21	1965		33
RAKOVEC	SOTLA					1926	1964	
SODNA VAS I	MESTINJŠČICA	97.98	546650	115730	195.896	1982		16
SODNA VAS	MESTINJŠČICA					1965	1981	
ZAGAJ	BISTRICA	93.63	550860	100400		1965	1983	
ZAGAJ I	BISTRICA	93.7	550770	100590	189.923	1984		14
BISTRICA OB SOTLI	BISTRICA	96.28	551120	101460		1954	1969	
BISTRICA OB SOTLI I	BISTRICA					1954	1969	
VRHNIKA I	LJUBLJANICA	KRAS				1926	1960	
VRHNIKA MOST	LJUBLJANICA	KRAS				1947	1986	
VRHNIKA II	LJUBLJANICA	KRAS	446110	91570	284.65	1961		37
KOMIN	LJUBLJANICA	1182.91	450670	91430	284.623	1954		44
LIPE	LJUBLJANICA					1954	1971	18
ŠPICA	LJUBLJANICA		462520	99420		1954	1988	35
MOSTE	LJUBLJANICA	1762.52	465490	101180	280.798	1952		46
VEVČE	LJUBLJANICA					1954	1982	
ZGORNJI KAŠELJ	LJUBLJANICA		469100	100450		1954	1982	
MIRKE	VELIKA LJUBLJANICA					1949	1981	
MIRKE	MALA LJUBLJANICA					1949	1982	
VRHNIKA I	HRIBŠČICA					1972	1986	
VRHNIKA	HRIBŠČICA					1954	1975	
RAZOR	PODLIPŠČICA					1954	1975	
RAZOR	KANAL PODLIPŠČICE					1958	1982	
VERD I	LJUBIJA	KRAS	446790	90570	286.507	1960		38
VERD	LJUBIJA	KRAS				1952	1959	
VERD	CEGLARJEV POTOK					1973	1979	
BISTRA I	BISTRA	KRAS	449150	89720	286.498	1956		42
BISTRA	BISTRA	KRAS				1952	1980	
DRENOV GRIČ	ZORNICA					1952	1982	
BOROVNICA	BOROVNIŠČICA	35.62	451490	85920	295.68	1954		44
PODPEČ	PODPEŠKI POTOK					1954	1982	
JEZERO	JEZERSKI POTOK					1957	1982	
BREZOVICA	DROBTINKA					1975	1963	
BREZOVICA	RADNA					1954	1982	
IŠKA	IŠKA	66.22	462530	86770	335.738	1969		29

VODOMERNA POSTAJA gauging station	VODOTOK stream	POVRŠINA catchmant area	KOORDINATE coordinates		KOTA "0" point (m.n.m.)	OPAZOVANJA observations		
		F (km²)	X	Y		ZAČ. begin	KON. end	ŠT.LET years
IG	IŽICA		464270	90470		1954	1988	
ŽELIMLJE	ŽELIMELJŠČICA					1954	1972	
ŠKOFLJICA	ŠKOFELJŠČICA					1954	1982	
RAZORI	GRADAŠČICA	106.13	456670	101010		1959	1982	
BELICA	GRADAŠČICA					1955	1982	
DVOR	GRADAŠČICA	78.67	449690	102220	341.122	1977		21
RAZORI	ŠUJICA	46.88	456860	100610	301.301	1954		44
ROŽNA DOLINA	GLINŠČICA					1954	1982	
BLOKE	BLOŠČICA					1968	1986	
VRHNIKA	VELIKI OBRH	KRAS	461840	62360		1961	1988	
PUDOB	VELIKI OBRH	KRAS	459550	61930		1952	1988	
KOZARIŠČE	MALI OBRH	KRAS				1954	1975	
SNEŽNIK	MALI OBRH	KRAS	459310	60110		1966	1975	
ŠMARATA	MALI OBRH	KRAS	458910	60570		1973	1988	
GOLOBINSKA JAMA	OBRH	KRAS				1954	1964	
GORENJE JEZERO	STRŽEN	KRAS	454060	65070	547.287	1954		44
DOLENJE JEZERO	STRŽEN	KRAS	450690	69240	545.556	1954		44
VODONOS	STRŽEN	KRAS				1954	1982	
GORIČICA	GORIČKI POTOK	KRAS				1961	1982	
LIPSENJ I	LIPSENJŠČICA	KRAS				1968	1983	
LIPSENJ	LIPSENJŠČICA	KRAS				1954	1988	
ŽEROVNICA	ŽEROVNIŠČICA	KRAS				1954	1988	
GRAHOVO	GRAHOVŠČICA	KRAS				1954	1982	
MARTINJAK	MARTINJŠČICA	KRAS				1961	1982	
CERKNICA I	CERKNIŠČICA	47.29	451000	72360	559.583	1961		37
CERKNICA	CERKNIŠČICA					1954	1960	
MALI NARAVNI MOST	RAK	KRAS				1974	1981	
SLIVICE	RAK	KRAS	445420	72460		1961	1986	
PRESTRANEK	PIVKA	KRAS	436650	65500	519.852	1954		44
ZALOG	PIVKA	KRAS				1974	1982	
POSTOJNSKA JAMA	PIVKA	KRAS	438420	71200	511.128	1950		48
HRENOVICE	NANOŠČICA					1961	1968	
MALI OTOK	NANOŠČICA	47.32	436650	71020	516.302	1968		30
PLANINSKA JAMA I	UNICA	KRAS	441760	75410		1974	1988	
PLANINSKA JAMA	UNICA	KRAS				1954	1973	
MOST V MALNE	UNICA	KRAS	442410	76240		1954	1982	
HASBERG	UNICA	KRAS	443170	76310	444.98	1926		72
LAZE	UNICA	KRAS	442980	79910		1954	1986	
JAKOVICA	UNICA	KRAS				1954	1966	
MALNI	MALENŠČICA	KRAS	442470	75710	442.019	1961		37
HOTEDRŠČICA	HOTENJKA	KRAS	433770	87700		1954	1988	
LOGATEC	LOGAŠČICA		438670	85510		1954	1988	
ROVTE	ROVTARICA	KRAS	437340	91490		1954	1985	
ZAPLANA	PETKOVEC	KRAS	438770	90460		1954	1982	
SOLČAVA	SAVINJA					1949	1958	
SOLČAVA I	SAVINJA	63.7	476760	141780	636.011	1959		39
LUČE I	SAVINJA	119.3	479890	135600		1980	1986	
LUČE	SAVINJA					1981	1988	
LJUBNO	SAVINJA	239.2	487640	132880		1954	1982	
NAZARJE	SAVINJA	457.3	496710	130800	336.97	1933		65
LETUŠ	SAVINJA	534.4	501780	130270	307.992	1951	1992	
LETUŠ I	SAVINJA	529.7	500710	131350		1994		4
LATKOVA VAS	SAVINJA					1954	1964	
CELJE II – BRV	SAVINJA	1189.2	520470	120400	230.248	1960		38
CELJE I	SAVINJA					1960	1972	
LAŠKO I	SAVINJA	1663.6	518410	112230	215.025	1953		45
LAŠKO	SAVINJA					1907	1952	
VELIKO ŠIRJE	SAVINJA					1955	1966	
VELIKO ŠIRJE I	SAVINJA	1841.9	515310	105360	189.957	1967		31
LUČE	LUČNICA	57.5	480800	134490	510.125	1954		44
ŠMIKLAVŽ	DRETA		481700	125700	503.55	1968	1979	
KRAŠE	DRETA	100.66	492730	126710	368.642	1958		40
PUSTO POLJE	DRETA	107.2	494555	127875		1947	1964	
ZGORNJI DOLIČ	PAKA	31.9	513810	141810		1953	1989	
VELENJE	PAKA	63.3	509490	135300	389.051	1953		45
ŠOŠTANJ	PAKA	131.2	504020	136920	352.983	1956		42

VODOMERNA POSTAJA gauging station	VODOTOK stream	POVRŠINA catchmant area F (km²)	KOORDINATE coordinates X	Y	KOTA "0" point (m.n.m.)	OPAZOVANJA observations ZAČ. begin	KON. end	ŠT.LET years
REČICA	PAKA	205.4	503330	130780	305.089	1972		26
PESJE	LEPENA					1964	1973	
PLEŠIVEC	VELUNJA	21.4	507310	141980		1954	1986	
GABRKE	VELUNJA	28.85	506460	138950	385.58	1986		12
ŠOŠTANJ	BEČOVNICA		503932	137676		1964	1974	
ŠOŠTANJ	TOPLICA	8.2	502940	137800		1964	1979	
GREBENŠEK	BELA VODA	3.64	498700	139620		1964	1979	
ŠOŠTANJ	ŠENTFLORJANŠČICA	15.9	501840	137980		1964	1979	
LOČICA	BOLSKA		496100	120400	356.001	1954	1980	
KAPLA	BOLSKA		501950	123380	291.77	1953	1982	
DOLENJA VAS	BOLSKA					1953	1961	
DOLENJA VAS II	BOLSKA	169.5	507590	121680	267.185	1962		36
BRASLOVČE	TREBNIK		503411	126804		1967	1975	
ZAKL	TRNAVCA		504130	124000		1969	1979	
ŽALEC	LAVA		512953	121960		1969	1975	
BREZOVEC	LOŽNICA		507330	128420	293.154	1951	1982	
LEVEC	LOŽNICA					1954	1966	
LEVEC I	LOŽNICA	102.89	517320	122220	240.951	1967		31
POLZELA	RAZBRE. LOŽNICE					1960	1971	
ZALOŽE	RAZBRE. LOŽNICE		507010	126670	286.66	1960	1975	
LEVEC	PIREŠICA		516960	122740	243.343	1972	1982	
PREŠNIK	SUŠNICA		518661	126789		1967	1974	
LOČE	KOPRIVNICA		520257	125469		1967	1976	
ČRNOLICA	VOGLAJNA	53.67	532290	116830	264.44	1959		39
CELJE II	VOGLAJNA	202.2	522110	120930	234.073	1966		2
CELJE I	VOGLAJNA S HUDINJO					1950	1966	
GROBELNO	SLOMSKI P.		534380	118880		1959	1989	
STRMEC	HUDINJA	68.8	521860	121950	285.008	1953	1989	
ŠKOFJA VAS	HUDINJA	156.5	522430	124490	243.807	1983		15
SPODNJA HUDINJA	HUDINJA		520320	121950	233.2	1954	1979	
REČICA	REČICA	2	516302	113421		1954	1968	
GRADIČEK	KRKA	KRAS	482270	82830		1954	1980	
VODIŠKO I	GRAČNICA	96.6	518420	107010		1991		8
KRKA	KRKA	KRAS				1954	1966	
PODBUKOVJE	KRKA	321.44	483760	81440	259.224	1959		39
DVOR	KRKA	533.97	497640	73750	175.458	1959		39
SREBRNIČE	KRKA	1313.04	509480	71770		1959	1989	
NOVO MESTO	KRKA	1762.14	513640	73090		1954	1982	
LOČNA	KRKA					1964	1971	
OTOČEC	KRKA					1961	1975	
GORENJA GOMILA	KRKA	1865.71	522550	80420	148.816	1962		36
DOBRAVA	KRKA					1961	1975	
MRŠEČA VAS	KRKA					1961	1971	
MALENCE	KRKA					1961	1975	
KOSTANJEVICA	KRKA					1945	1975	
PODBOČJE	KRKA	2238.12	535740	80120	146.323	1926		72
CERKLJE	KRKA					1961	1975	
BORŠT	KRKA					1961	1975	
KRŠKA VAS	KRKA	2346.37	544800	83190		1954	1978	
MLAČEVO	GROSUPELJŠČICA	34.08	476020	88410	324.069	1954		44
MALA RAČNA	ŠICA	KRAS	476560	83840		1960	1982	
RAŠICA	RAŠICA	58.48	471600	78660	473.3	1954		44
GRADIČEK	POLTARICA	KRAS	482410	82540		1954	1988	
TREBNJA GORICA	VIŠNJICA	75.69	483280	82590	267	1954		44
MENIŠKA VAS	RADEŠCA	287.13	503440	67940	168.44	1961		37
DOLENJSKE TOPLICE I	SUŠICA	KRAS				1975	1969	
DOLENJSKE TOPLICE	SUŠICA	KRAS				1975	1969	
ROŽNI VRH	TEMENICA	80.87	500100	84840	268.165	1956		42
VRHPEČ	TEMENICA	111.25	505490	81360		1963	1982	
GORIŠKA VAS	TEMENICA	121.96	507080	77350		1956	1982	
PREČNA	PREČNA	294.17	508830	74510	163.819	1953		45
STOPIČE	TEŽKA VODA	14.54	516170	69230		1955	1988	
GOTNA VAS	TEŽKA VODA	87.49	514280	71550		1955	1964	
KLEVEVŽ	RADULJA	47.79	518600	84700		1960	1982	
ŠKOCJAN	RADULJA	107.96	523020	84860	159.714	1961		37
ZALOKE	LOKAVEC	15.89	531420	84530		1954	1969	

VODOMERNA POSTAJA gauging station	VODOTOK stream	POVRŠINA catchmant area	KOORDINATE coordinates		KOTA "0" point (m.n.m.)	OPAZOVANJA observations		
		F (km^2)	X	Y		ZAČ. begin	KON. end	ŠT.LET years
DOLNJA PREKOPA	PLETERSKI POTOK	18.9	530990	78940		1960	1986	
GLOBOČICE	STUDENA		532720	77120		1960	1972	
MALO MRAŠEVO	SENUŠA	38.89	534820	80740		1960	1988	
PODBOČJE	SUŠICA	37.84	536630	80160		1954	1988	
SODRAŽICA	BISTRICA	29.89	472340	68450	528.891	1960		38
RIBNICA	BISTRICA					1954	1982	
ŽLEBIČ	TRŽIŠČICA	17.03	476430	69280		1960	1982	
ŽLEBIČ	RAZBRE. TRŽIŠČICE		477260	69100		1963	1982	
PRIGORICA I	RIBNICA	KRAS	479970	63060	481.78	1989		9
PRIGORICA	RIBNICA	KRAS	481000	62910	479.46	1954	1988	
RAKITNICA	RAKITNICA	KRAS				1954	1982	
TRAVNIK	LOŠKI POTOK	KRAS				1961	1981	
POKOLPJE								
PETRINA	KOLPA	460	488840	35530	219.683	1952		46
RADENCI I	KOLPA					1956	1977	22
RADENCI II	KOLPA	1191	507530	35620	175.246	1978		20
METLIKA	KOLPA	2002	525550	54500	127.18	1952		46
ČRNI POTOK	ČABRANKA	54.28	475460	49270	435	1954	1992	
ČRNI POTOK	ČRNI POTOK	10.56	475500	49640		1954	1970	
PAPEŽI	BELICA	26.28	477210	46930		1954	1988	
SLOVENSKA VAS	RINŽA ZAJETJE	KRAS	486830	57910		1956	1982	
SLOVENSKA VAS	RINŽA	KRAS	487350	57800		1956	1988	
MAHOVNIK	RINŽA	KRAS				1954	1964	
LIVOLD	RINŽA	KRAS				1978	1989	
LIVOLD I	RINŽA	KRAS	491700	51210	453.67	1977		21
GRADAC	LAHINJA	221.32	519320	52350	128.998	1952		46
DOLENCI	KRUPA	117.71	518860	53400		1956	1979	
POSOČJE								
TRENTA	SOČA	39.22	403880	139270		1954	1988	
ZGORNJA SOČA	SOČA	90.19	399130	133990		1953	1982	
KRŠOVEC	SOČA	157.21	392620	133590	403.469	1954		44
ČEZSOČA	SOČA	267.21	389100	132190		1959	1976	
LOG ČEZSOŠKI	SOČA	323.38	384400	131190	341.248	1928		70
KOBARID I	SOČA	434.7	391370	123620	195.859	1928		70
ŠENTMAVER	SOČA					1957	1965	
SOLKAN I	SOČA	1572.8	396180	93920	51.844	1980		18
SOLKAN	SOČA	1573.8	395840	93500		1928	1979	
SOLKAN MEJA	SOČA					1958	1971	
TRENTA	ZADNJICA	23.15	404510	138270		1954	1988	
LEPENA	LEPENA	13.85	396840	130900		1963	1982	
LOG POD MANGARTOM	KORITNICA	40.64	391440	138400		1954	1982	
KAL	KORITNICA	85.47	390660	134010	404.613	1953		45
LOG POD MANGARTOM	MOŽNICA					1956	1966	
ŽAGA	UČJA	49.41	383200	130640	342.501	1953		45
MLINSKO	IDRIJA	20.52	391060	122570		1956	1966	
LADRA	ROČICA	10.35	392740	122330		1954	1966	
SELIŠČE	VOLARJA	18.05	396630	119490		1955	1963	
TOLMIN	TOLMINKA	73.08	402760	116670	167.736	1953		45
ZADLAZ	ZADLAZKA	14.53	405020	119650		1951	1966	
PODROTEJA I	IDRIJCA	112.84	425270	94080	327.04	1977		21
PODROTEJA	IDRIJCA					1954	1976	
SPODNJA IDRIJA	IDRIJCA	203.35	425840	99780		1947	1971	
REKA	IDRIJCA	313.22	417230	108300		1935	1989	
DOLENJA TREBUŠA	IDRIJCA					1954	1971	
PLEŠCE	IDRIJCA					1957	1966	
OBLAZ	IDRIJCA					1957	1966	
SPODNJA VODA	IDRIJCA					1957	1966	
HOTEŠK	IDRIJCA	442.83	407130	110080	160.81	1940		58
CERKNO I	CERKNICA	42.02	420510	108620		1981	1989	
CERKNO	CERKNICA					1956	1981	
CERKNO II	CERKNICA	40.3	421130	108840	289.378	1991		7
TREBENČE	ZAPOŠKI POTOK	7.78	421690	111640		1954	1966	
DOLENJA TREBUŠA	TREBUŠA	54.7	410110	106270	186.225	1954		44
KORITNICA	BAČA		413140	113790		1954	1987	
GRAHOVO	BAČA					1954	1985	
BAČA PRI MODREJU	BAČA	142.31	405850	113170	164.428	1940		58

VODOMERNA POSTAJA gauging station	VODOTOK stream	POVRŠINA catchmant area F (km²)	KOORDINATE coordinates X	Y	KOTA "0" point (m.n.m.)	OPAZOVANJA observations ZAČ. begin	KON. end	ŠT.LET years
KORITNICA	KORITNICA		413170	113920		1953	1966	
KNEŽA	KNEŽA	35.48	409810	113760		1953	1966	
NOVA GORICA I	KOREN	6.1	394490	90760	84.037	1986		12
VIPAVA	VIPAVA					1948	1966	
VIPAVA I	VIPAVA	105.55	419750	78080	96.376	1959		39
DOLENJE	VIPAVA	322.53	415070	80820	51.59	1993		5
DORNBERK	VIPAVA	472.47	402680	83110	54.298	1951		47
MIREN	VIPAVA	593.9	392410	84250	37.019	1950		48
PODNANOS	MOČILNIK	29.01	420610	73250	159.305	1981		17
AJDOVŠČINA	HUBELJ	KRAS				1954	1960	
AJDOVŠČINA I	HUBELJ	KRAS	415420	83820	107.403	1955		43
BRANIK	BRANICA	KRAS	407490	79240	82.149	1981		17
ŠMIHEL	LIJAK	KRAS	400800	91030	69.763	1963		35
VOLČJA DRAGA	LIJAK	KRAS	398180	84790	45.017	1982		16
BEZOVLJAK	VOGRŠČEK	11.18	401210	85360	66.533	1983		15
NEBLO	REKA	30.95	382820	96530	73.131	1981		17
GOLO BRDO	IDRIJA	57.04	384110	102290	101.633	1956		42
NEBLO	KOŽBANJŠČEK	14.97	384520	96440	79.258	1984		14
POTOKI	NADIŽA	100.2	384420	123950	247.982	1956		42
JADRANSKO POVODJE (del) / Adriatic drainage basin (part)								
KOSEZE	REKA		441190	46260		1957	1982	
TRNOVO	REKA	129.08	439960	47920	393.054	1953		45
CERKVENIKOV MLIN	REKA	332.37	427260	57080	341.716	1952		46
VREME	REKA	KRAS	424160	57520	331.158	1908	1982	
ŠKOCJAN	REKA	KRAS				1957	1966	
ILIRSKA BISTRICA	BISTRICA	KRAS	441140	47960	353.356	1957		41
OSTROVICA	PADEŽ					1973	1981	
SUHORJE	PADEŽ					1954	1986	
BREZOVICA	LOČICA					1962	1982	
OSP	OSAPSKA REKA	KRAS				1963	1975	
OSP I	OSAPSKA REKA	KRAS				1963	1975	
OSP	GABROVIŠKI POTOK	KRAS				1963	1975	
BEZOVICA	RIŽANA					1955	1962	
KUBED II	RIŽANA	204.5	412680	43680	57.682	1965		33
KUBED I	RIŽANA					1924	1964	
KUBED	RIŽANA					1924	1964	
ŠALARA	BADAŠEVICA	21.08	402690	42740		1994		4
PIŠČINA	DRNICA	29.77	393711	36653	1.781	1955		43
PODKAŠTEL I	DRAGONJA	92.71	395110	35150	5.86	1987		11
PODKAŠTEL	DRAGONJA					1954	1983	
KOPER	JADRANSKO MORJE		400770	45640		1956	1990	
LUKA KOPER	JADRANSKO MORJE		402400	47470	-2.038	1990		8

KRAS: Površina zaledja ni bila določena ali ocenjena / Catchmant area was not determined nor assessed
ČENTIBA: Delujoče postaje v letu 1997 / Operating gauging stations in year 1997
10197*: Podatek vzet iz Hidrološkega godišnjaka 1986 / Data taken from Hidrološki godišnjak, 1986

Annex 4.2.

Standards for Water and Sediment Quality Sampling and Determination

Standards for Water and Sediment Quality Sampling and Determination

Parameter	Unit	Reference method	Method	Measuring principle	filtered/unfiltered samples	Certificate of analysis
pH		ISO 10523		electrometric	unfiltered	#GLP instr.
Conductivity	µS/cm (25°)	ISO 7888		electrometric	unfiltered	#GLP instr.
free carbonic acid	mg/l		proc. with NaOH	titrimetric	unfiltered	no
chloride	mg/l	SM 4500 C. literature (1)	proc. with $Hg(NO_3)_2$	titrimetric	filtered	yes
sulphate	mg/l	literature (2)	titration by thorin	titrimetric	filtered	yes
nitrite	mg NO_2/l	DIN 38405	proc. with sulfanilic acid solution	spectrophotometric	unfiltered	yes
nitrate	mg NO_3/l		Na-salicylate procedure	spectrophotometric	filtered	yes
ammonium*	mg NH_4/l	ISO 7150/1	proc. with nessler reagent	spectrophotometric	unfiltered	yes
alkalinity	mg/l	ISO 9963-1		titrimetric	filtered	yes
calcium	mg/l	ISO 6058	proc. with NaEDTA	titrimetric	filtered	yes
magnesium	mg/l	SM 3500 E. literature (1)	proc. with NaEDTA	titrimetric	filtered	yes
sodium and potassium	mg/l	ISO 9964-3	flame photometry	emission spectrometry	unfiltered	yes
orthophosphate** (active P)	mg PO_4/l	SIST EN 1189 (modificated)	proc with ammonium molybdate solution	spectrophotometric	filtered	yes
total phosphorus**	mg PO_4/l	SIST EN 1189 (modificated)	proc with ammonium molybdate solution	spectrophotometric	filtered	yes
suspended solids	mg/l	ISO 6107		gravimetric		no
Parameter	Unit	Reference method	Method	Measuring principle	filtered/unfiltered samples	Certificate of analysis

Parameter	Unit	Reference method	Method	Measuring principle	filtered/unfiltered samples	Certificate of analysis
dissolved oxygen	mg O_2/l	SIST EN 25813 SIST EN 25814	titration acc. Winkler measured by means of a probe (WTW)	titrimetric electrometric-probe	unfiltered	no????
COD ($K_2Cr_2O_7$)	mg O_2/l	ISO 6060	proc. with $K_2Cr_2O_7$	titrimetric	unfiltered	yes???
COD ($KMnO_4$)	mg O_2/l	DIN 38409-H4	proc with $KMnO_4$	titrimetric	unfiltered	yes???
BPK_5	mg O_2/l	EN 1899-2:1995E		titrimetric	unfiltered	no????
silica	mg/l	SM 4500 D. literature (1)	proc with ammonium molybdate solution	spectrophotometric	filtered	no
aluminium	mg/l	DIN 38406-E9	proc. with alizarin	spectrophotometric	filtered	no
iron	mg/l	SM 3500 D. literature (1)	proc. with 1,10-phenanthroline	spectrophotometric	filtered	no
phenols	mg/l	DIN 38409-H16	proc. with 4-aminoantipyridine	spectrophotometric	unfiltered	yes
mineral oils	mg/l	literature (3)	fluorescence measurements in hexane-extract	fluorescence spectrophotometry	unfiltered	no
anionic active surfactants	mg MBAS/l	EN 903, ISO 7875	methylene-blue method	spectrophotometric	unfiltered	no
lignosulphonate	mg/l	literature (4)	fluorescence method	fluorescence spectrophotometry	unfiltered	no

means that instrument have GLP-quality assurance for good laboratory practise

* *since 1998 ammonium is measured according SM 4500 C (literature 1), isostandard method*

** *till 1998 the measuring principle were calorimetric*

Literature:

1. *Standard Methods for the Examination of Water and Wastewater, 18th edition, APHA - AWWA - WEF (1992)*
2. *Fritz J.S., Yamamura S.S., Anal.Chem.* ***27*** *(9), 1461 (1995)*
3. *Manual for Monitoring Oil and Dissolved/Dispersed Petroleum Hydrocarbon in Marine Waters and on Beaches, UNESCO 13/1984*
4. *Thruston A.D., J. Water Poll.Fed.* ***42****, 1551 (1970)*

Annex 4.4.2.-1

The River Cross-sections (profiles), Tabulated

The river cross-sections are presented in the form of coordinates ZZ, BB, where:

ZZ means elevation above sea level in m of the point in the cross section (river profile), at which the width BB in m of the cross section is measured.

CHANNEL CROSS SECTIONS

River: MURA

VP Cmurek (stacionated at km 117.762)

ZZ = 225.1	BB = 52.0
ZZ = 225.9	BB = 62.2
ZZ = 227.9	BB = 71.4
ZZ = 229.8	BB = 79.4
ZZ = 230.7	BB = 96.0

VP Gornja Radgona (stacionated at km 100.697)

ZZ = 201.60	BB = 9.4
ZZ = 203.00	BB = 73.6
ZZ = 203.30	BB = 87.4
ZZ = 206.65	BB = 103.8

VP Petejanci (stacionated at km 95.500)

ZZ = 194.38	BB = 41.6
ZZ = 195.03	BB = 63.2
ZZ = 195.98	BB = 69.4
ZZ = 197.83	BB = 74.6
ZZ = 198.33	BB = 91.2

River: DRAVA

ABOVE DAM HE Dravograd (stacionated at km 138.36)

ZZ = 330.20	BB = 4.5
ZZ = 331.60	BB = 40.7
ZZ = 333.95	BB = 82.6
ZZ = 337.90	BB = 101.4
ZZ = 339.50	BB = 328.0
ZZ = 345.00	BB = 357.1

BELOW DAM HE Dravograd

ZZ = 328.60	BB = 67.6
ZZ = 328.80	BB = 86.8
ZZ = 329.45	BB = 128.1
ZZ = 333.40	BB = 137.8

ABOVE DAM HE Vuzenica (stacionated at km 126.456)

ZZ = 325.4	BB = 78
ZZ = 327.8	BB = 124
ZZ = 330.0	BB = 204
ZZ = 335.0	BB = 215

BELOW DAM HE Vuzenica

ZZ = 315	BB = 134
ZZ = 318	BB = 139
ZZ = 322	BB = 165

ABOVE DAM HE Vuhred (stacionated at km 113.334)

ZZ = 304.4	BB = 74.0
ZZ = 308.2	BB = 103.0
ZZ = 308.6	BB = 111.5
ZZ = 324.0	BB = 192.0

BELOW DAM HE Vuhred

ZZ = 286.5	BB = 11
ZZ = 291.8	BB = 74
ZZ = 292.2	BB = 78
ZZ = 293.0	BB = 81
ZZ = 299.2	BB = 128
ZZ = 306.0	BB = 217

ABOVE DAM HE Ožbolt (stacionated at km 100.648)

ZZ = 282.0	BB = 52.00
ZZ = 285.0	BB = 72.00
ZZ = 286.0	BB = 92.00
ZZ = 288.5	BB = 110.00
ZZ = 298.0	BB = 147.00
ZZ = 305.0	BB = 157.29

BELOW DAM HE Mariborski otok (stacionated at km 76.545)

ZZ = 243.8	BB = 8.0
ZZ = 247.5	BB = 25.6
ZZ = 250.0	BB = 133.6
ZZ = 255.0	BB = 159.4
ZZ = 266.0	BB = 184.0

ABOVE DAM HE SD1 (stacionated at km 70.500)

ZZ = 243.0	BB = 2.4
ZZ = 243.8	BB = 26.0
ZZ = 244.4	BB = 61.8
ZZ = 246.0	BB = 99.6
ZZ = 247.0	BB = 109.8
ZZ = 254.6	BB = 133.0
ZZ = 257.0	BB = 270.0

BELOW DAM HE SD1

ZZ = 243.95	BB = 47.8
ZZ = 244.50	BB = 53.8
ZZ = 244.90	BB = 91.2
ZZ = 245.10	BB = 109.7
ZZ = 245.40	BB = 130.6
ZZ = 245.80	BB = 134.2
ZZ = 247.00	BB = 138.6

ABOVE DAM HE SD2 (stacionated at km 45.760)

ZZ = 208.0	BB = 80
ZZ = 209.0	BB = 122
ZZ = 212.5	BB = 220
ZZ = 213.0	BB = 301
ZZ = 218.0	BB = 400
ZZ = 221.5	BB = 500

BELOW DAM HE SD2 (in natural channel flows only biological minimum, the main discharge flows in artificial channel for power plant)

Natural channel:

ZZ = 211	BB = 150
ZZ = 216	BB = 250

Artificial channel:

Base: 20.0 m

Theta: 26.57°

Dravinja (stacionated at km cca 40.0)

ZZ = 206.5	BB = 420
ZZ = 209.5	BB = 500
ZZ = 210.0	BB = 570

Pesnica (stacionated at km cca 13.0)

ZZ = 200.6	BB = 30
ZZ = 201.5	BB = 100
ZZ = 204.1	BB = 120
ZZ = 205.8	BB = 650

River: SAVA

VP Radovljica (stacionated at km 900.950)

Y = 7.0	Z = 411.31
Y = 17.0	Z = 410.43
Y = 22.0	Z = 409.63
Y = 30.0	Z = 408.79
Y = 35.0	Z = 407.76
Y = 40.0	Z = 407.40
Y = 42.0	Z = 407.59
Y = 49.0	Z = 406.64
Y = 63.0	Z = 406.59
Y = 67.0	Z = 406.30
Y = 71.0	Z = 407.24
Y = 79.0	Z = 407.31
Y = 84.0	Z = 407.88
Y = 86.4	Z = 408.79

VP Medno (stacionated at km 860.440)

Y = 20.6	Z = 306.35
Y = 36.6	Z = 304.69
Y = 28.6	Z = 302.86
Y = 47.0	Z = 301.56
Y = 48.0	Z = 301.82
Y = 51.0	Z = 301.17
Y = 52.0	Z = 300.97
Y = 54.0	Z = 300.30
Y = 70.0	Z = 300.34
Y = 80.0	Z = 299.01
Y = 92.0	Z = 298.79
Y = 96.0	Z = 300.89
Y = 100.0	Z = 300.65
Y = 110.0	Z = 302.49

Y = 113.6	Z = 303.34
Y = 114.0	Z = 305.55

VP Litija (stacionated at km 818.650)

Y = 28.3	Z = 231.60
Y = 41.0	Z = 230.57
Y = 49.0	Z = 230.45
Y = 63.0	Z = 230.30
Y = 71.0	Z = 229.90
Y = 75.0	Z = 229.89
Y = 81.0	Z = 229.65
Y = 91.0	Z = 229.05
Y = 99.0	Z = 229.75
Y = 104.0	Z = 230.03
Y = 109.0	Z = 231.45
Y = 111.4	Z = 231.56

Below DAM HE Vrhovo (stacionated at km 777.490)

ZZ = 187.60	BB = 0.0
ZZ = 188.40	BB = 24.0
ZZ = 190.00	BB = 43.0
ZZ = 195.40	BB = 79.0
ZZ = 196.00	BB = 88.0
ZZ = 197.50	BB = 94.0
ZZ = 197.80	BB = 99.0
ZZ = 198.60	BB = 102.0
ZZ = 203.80	BB = 128.0
ZZ = 205.20	BB = 146.0

stacionated at km 757490

ZZ = 169.00	BB = 0.0
ZZ = 170.50	BB =100.0
ZZ = 170.70	BB = 128.0
ZZ = 175.00	BB = 150.0
ZZ = 179.50	BB = 150.0
ZZ = 180.00	BB = 160.0

Above VP Čatež (stacionated at km 737.770)

Y = 0.0	Z = 160.00
Y = 6.0	Z = 159.84
Y = 12.0	Z = 159.68
Y = 18.0	Z = 159.52
Y = 24.0	Z = 159.36
Y = 30.0	Z = 159.20
Y = 43.5	Z = 155.00
Y = 57.0	Z = 151.90
Y = 70.5	Z = 150.10
Y = 84.0	Z = 149.90
Y = 97.5	Z = 149.30
Y = 111.0	Z = 149.07
Y = 124.5	Z = 149.40
Y = 138.0	Z = 149.60
Y = 151.5	Z = 151.00
Y = 165.0	Z = 155.20
Y = 183.3	Z = 155.20
Y = 202.6	Z = 155.90
Y = 221.4	Z = 157.23
Y = 240.2	Z = 157.28
Y = 259.0	Z = 160.10

Below VP Čatež (stacionated at km 737.335)

Y = 0.0	Z = 158.60
Y = 19.4	Z = 155.40
Y = 38.8	Z = 155.40
Y = 58.2	Z = 155.40
Y = 77.6	Z = 155.40
Y = 97.0	Z = 155.40
Y = 108.6	Z = 149.97
Y = 120.2	Z = 149.68
Y = 131.8	Z = 149.39
Y = 143.4	Z = 149.09
Y = 155.1	Z = 148.80
Y = 166.7	Z = 149.09
Y = 178.3	Z = 149.39
Y = 189.9	Z = 149.68
Y = 201.5	Z = 149.97
Y = 213.1	Z = 155.80
Y = 220.1	Z = 156.00
Y = 227.1	Z = 156.00
Y = 234.1	Z = 156.00
Y = 241.1	Z = 156.00
Y = 248.1	Z = 160.60

Above VP Jesenice (stacionated at km 729.240)

Y = 0.0	Z = 147.50
Y = 268.0	Z = 147.00
Y = 536.0	Z = 146.50
Y = 804.0	Z = 146.50
Y = 1072.0	Z = 146.96
Y = 1340.0	Z = 148.00
Y = 1349.0	Z = 141.00
Y = 1358.0	Z = 141.00
Y = 1367.0	Z = 141.00
Y = 1376.0	Z = 141.00

Y = 1385.0	Z = 141.00
Y = 1394.0	Z = 141.00
Y = 1403.0	Z = 141.00
Y = 1412.0	Z = 141.00
Y = 1421.0	Z = 141.55
Y = 1430.0	Z = 148.00
Y = 1565.0	Z = 146.52
Y = 1700.0	Z = 147.18
Y = 1835.0	Z = 147.66
Y = 1970.0	Z = 147.83
Y = 2105.0	Z = 149.00

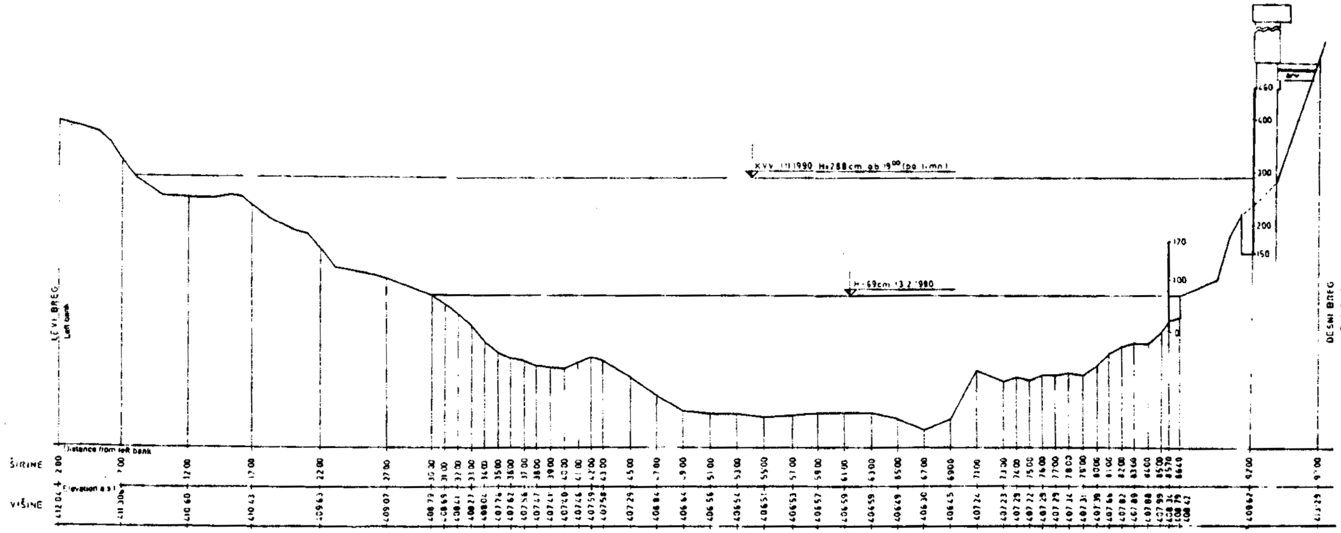
Below VP Jesenice (stacionated at km 729.840)

Y = 0.0	Z = 147.50
Y = 274.0	Z = 146.12
Y = 548.0	Z = 145.74
Y = 822.0	Z = 146.50
Y = 1096.0	Z = 146.50
Y = 1370.0	Z = 147.60
Y = 1378.8	Z = 141.16
Y = 1387.6	Z = 140.69
Y = 1396.4	Z = 140.68
Y = 1405.2	Z = 140.66
Y = 1414.0	Z = 140.65
Y = 1422.8	Z = 140.64
Y = 1431.6	Z = 140.62
Y = 1440.4	Z = 140.61
Y = 1449.2	Z = 141.63
Y = 1458.0	Z = 147.60
Y = 1561.6	Z = 147.09
Y = 1665.2	Z = 146.58
Y = 1768.8	Z = 146.06
Y = 1872.4	Z = 145.55
Y = 1976.0	Z = 148.20

Annex 4.4.2.-2

The River Cross-sections (profiles), Sketched

HIDROMETEOROLOŠKI ZAVOD RS
LJUBLJANA



CROSS SECTION OF WATER-LEVEL-GAUGE ON RIVER SAVA AT RADOVLJICA

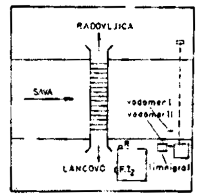
NAČRT VODOMERSKE POSTAJE NA SAVI - v.p. RADOVLJICA

MERILO ŠIRINE 1:200
VIŠINE 1:50

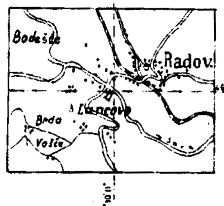
Vodomer je dvodelen.
Vodomer I je od 0 do 1.70m pritrjen na pol tračnicah.
Vodomer II je od 1.50 do 4.60m na limnigrafski jašek.
Limnigrafski aparat je SEBA.
„0" vodomera ima koto 408.086m. Base of water-level-gauge

F.T.1 - reper T.36 na niši št. 22 - MULEJ RUDI s koto 414.457m
F.T.2 - križ vklesan v 4. stopnico praga hiše št. 22 s koto 414.247m.

SKICA



SITUACIJA 1:75000



LJUBLJANA APRIL '90

MERIL BURGER
RISAL BURGER

Cross section of water-level-gauge on river Sava at Medno

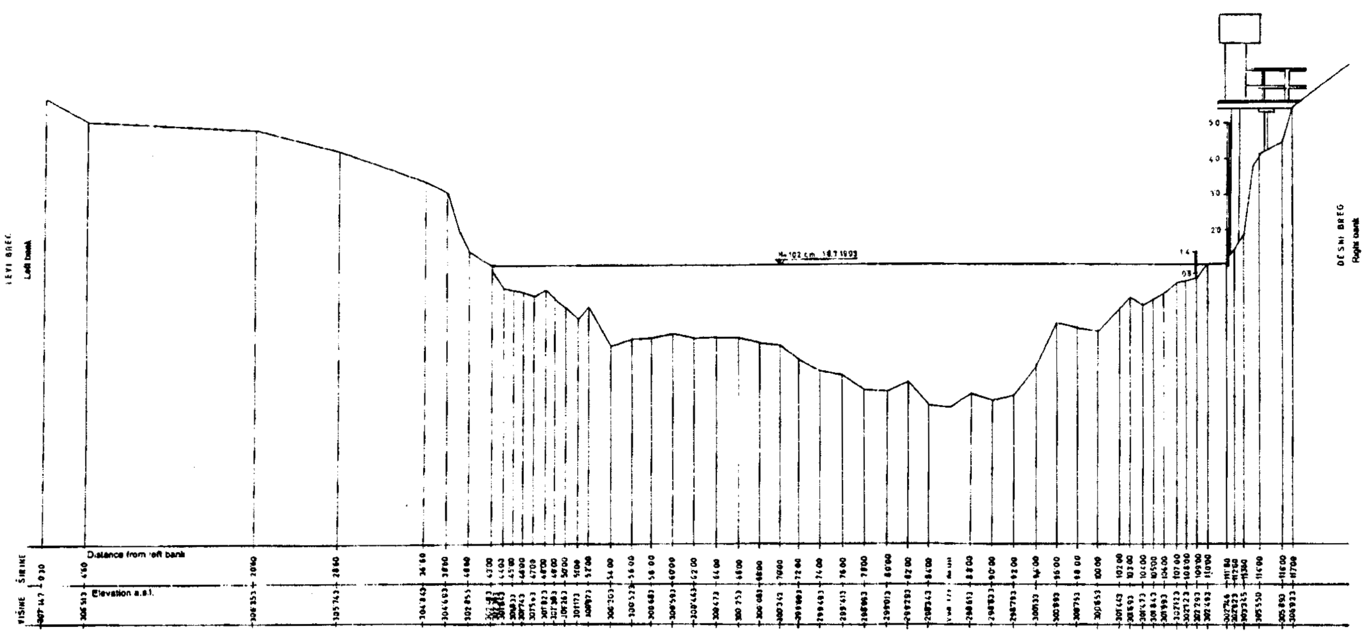
Načrt vod. postaje na Savi – v.p. Medno

MERILO ŠIRINE 1:250
VIŠINE 1:75

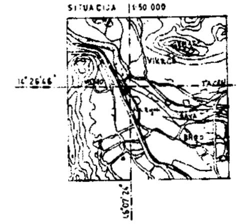
Začetek delovanja: 3.10.1967

OPIS VODOMERJEV:
I. del je od 0.8 do 1.4 m
II. del je od 1.0 do 5.0 m
0 vodomera ima koto 301.473 m **Base of water-level-gauge**

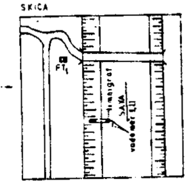
OPIS FIKSNIH TOČK
FT1 je točka vzidana v oporni zid mosta gorvodno od vp in ima koto 311.858 m
FT2 je reper 41.813 vzidan v [illegible] CIRMAN in ima koto 320.0467 m



SITUACIJA 1:50 000

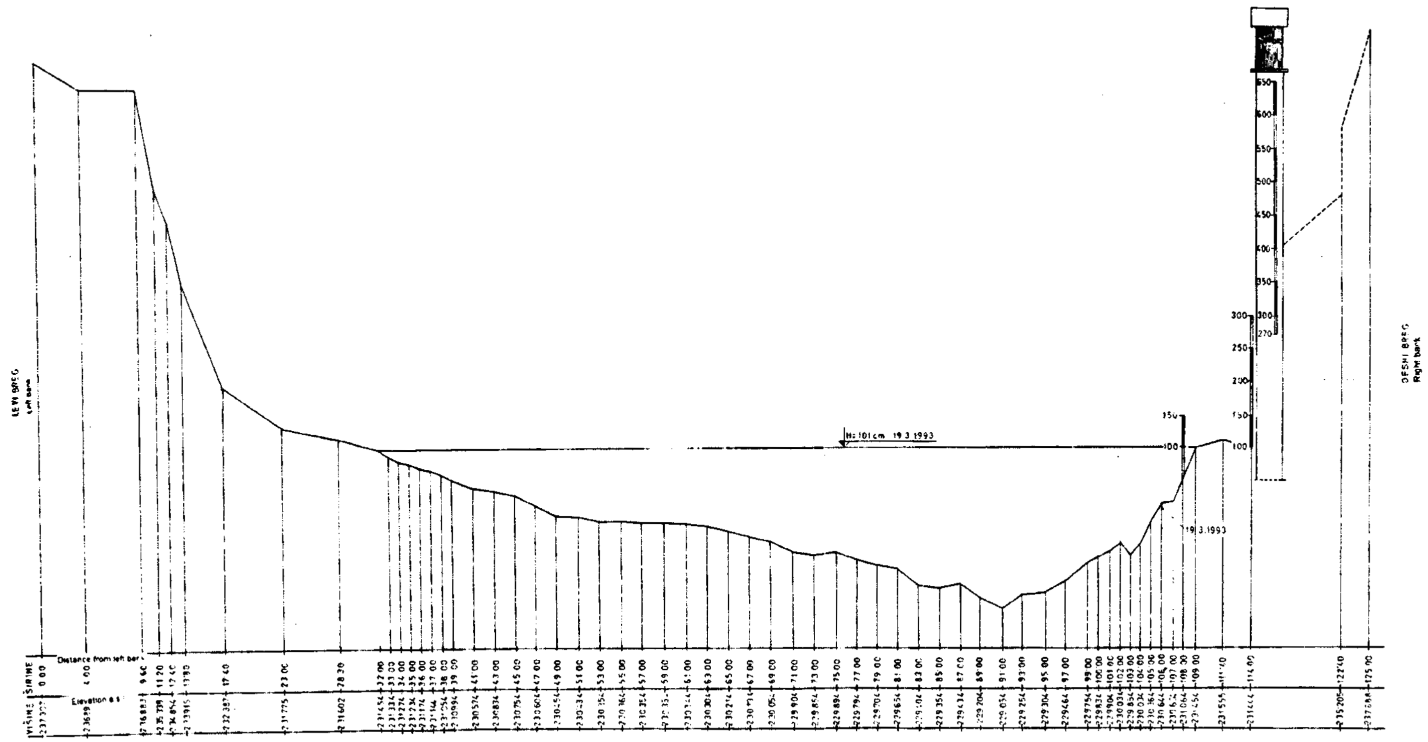


SKICA



LJUBLJANA, MAREC '93

MERIL: Burger
RISAL: [illegible]



Cross section of water-level-gauge on river Sava at Litija

Načrt vod.postaje na Savi-vp Litija

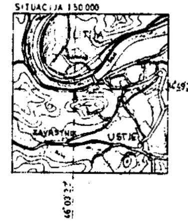
MERILO ŠIRINE 1:250
VIŠINE 1:40

Postaja je bila ustanovljena leta 1850 (limnigraf od 1897)
Nova vodomerska postaja z limnigrafom je pričela delovati 27.3.1953

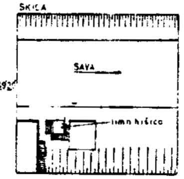
OPIS VODOMEROV
Vodomer je trodelen
I del vodomera je od
II del vodomera je od 1.0 do 3.0 m
III del vodomera je od 2.7 do 6.5 m
„0" vodomera ima koto 230.444 m. Base of water-level-gauge

OPIS FIKSNIH TOČK
FT 1 je reper 5211 na žel.postaji v Litiji in ima koto 239.784 m
FT 2 je reper vzidan v hišo Potokar Staneta - Litija št. 3 in ima koto 241.360 m.
FT 3 je spodnja železna vez vbetonirana v jašek limnigrafa in ima koto 233.800 m

SITUACIJA 1:50 000



SKICA



LJUBLJANA/APRIL'93 MERIL Burger
RISAL Burger

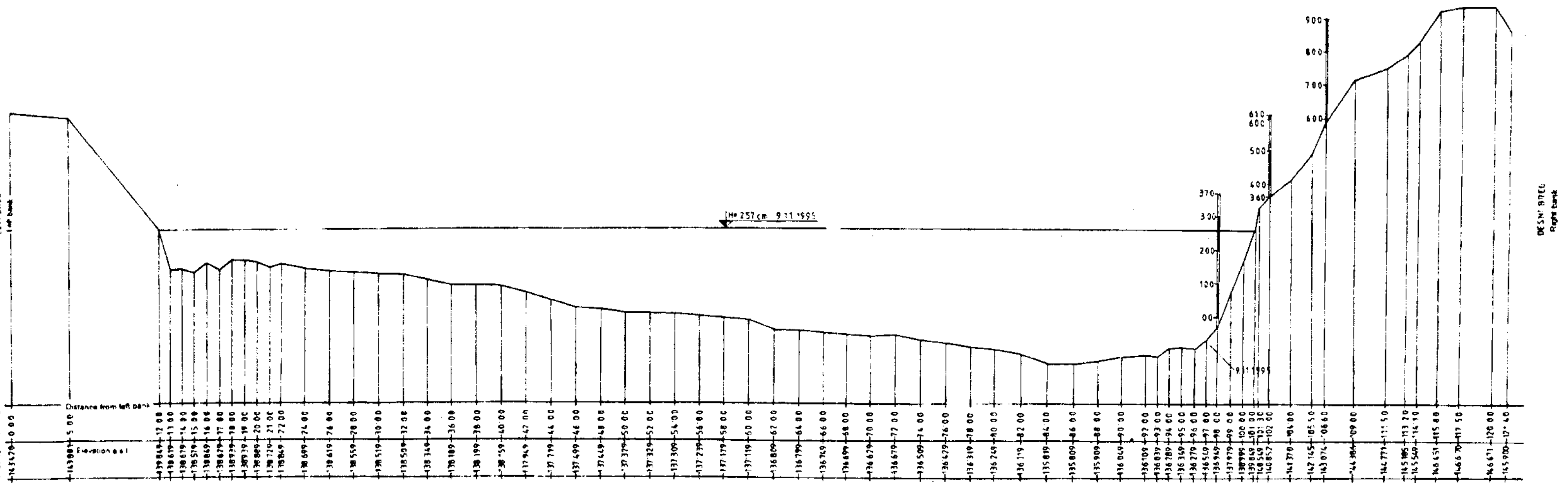
Cross section of water-level-gauge on river Sava at Čatež

Načrt vod postaje na Savi – v.p. Čatež

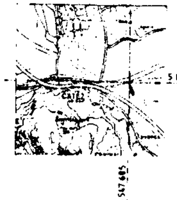
MERILO ŠIRINE 1:200
VIŠINE 1:75

OPIS VODOMEROV
I del vodomera je od 1.00 do 3.70 m
II del vodomera je od 3.60 do 6.10 m
III del vodomera je od 6.00 do 9.00 m
„0" vodomera ima koto 137.279 m   Base of water-level-gauge

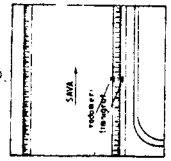
OPIS FIKSNIH TOČK
FT je vrh obrambnega zidu s koto 146.360 m.



SITUACIJA 1:50 000



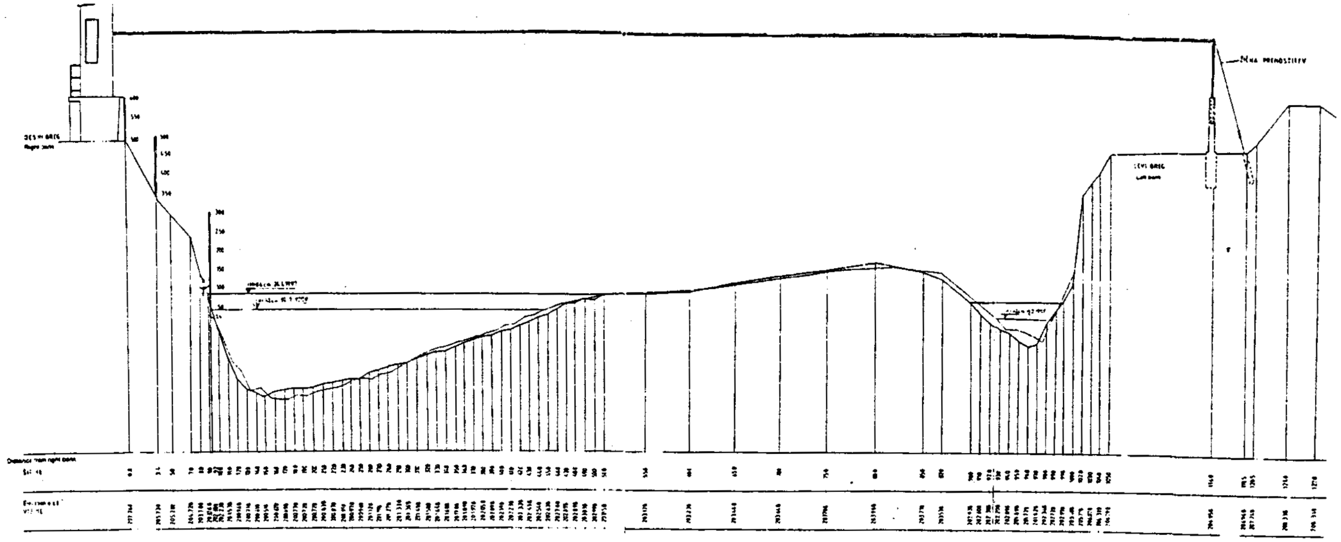
SKICA

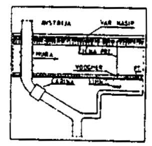


LJUBLJANA, FEB 96

MERIL Burger
RISAL Burger

NAČRT V. P. MURA-GORNJA RA DGONA
CROSS SECTION OF WATER-LE'EL-GAUGE ON F
MURA AT GORNJA RADGONA





HMZ RS
LJUBLJANA

CROSS SECTION OF WATER-LEVEL-GAUGE ON RIVER MURA AT PETANJCI

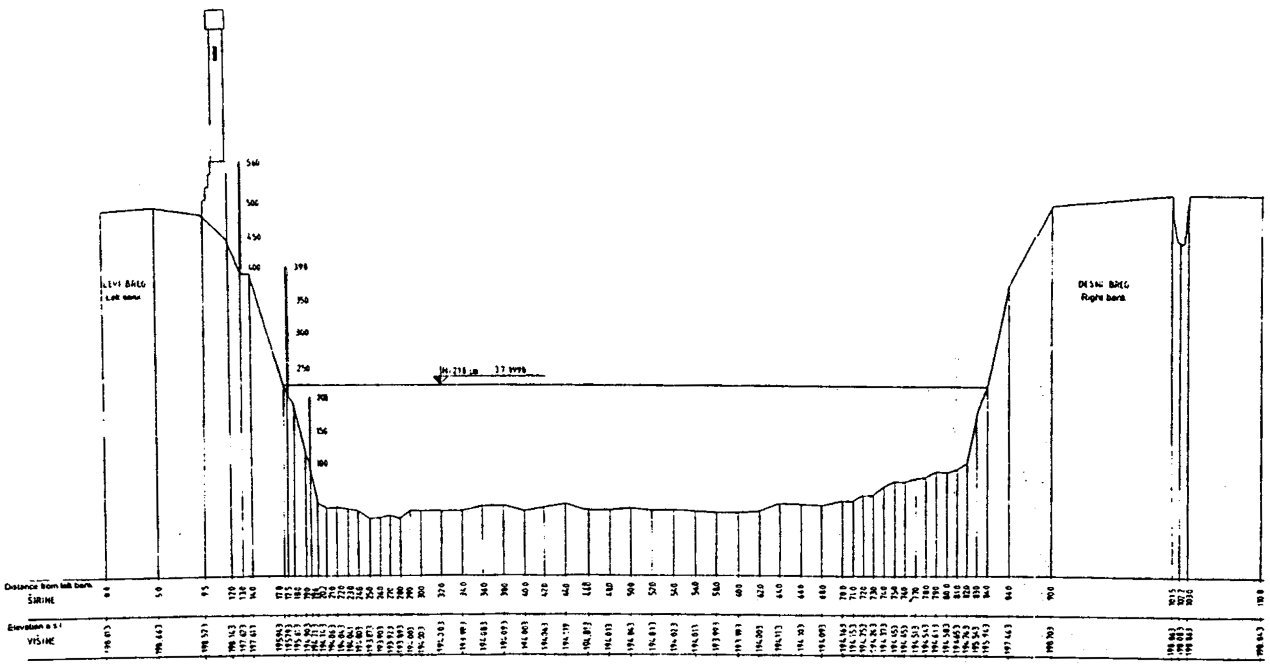
NAČRT VODOMERNE POSTAJE MURA - PETANJCI

MERILO	ŠIRINE	1:250
	VIŠINE	1:40

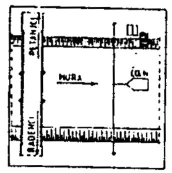
VODOMER JE TRODELEN IZ HRASTOVEGA PLOHA S PLASTI... PRITRJEN NA TRAČNICI.

I DEL VODOMERA	JE	OD	50	DO	200 cm
II DEL VODOMERA	JE	OD	180	DO	398 cm
III DEL VODOMERA	JE	OD	380	DO	560 cm

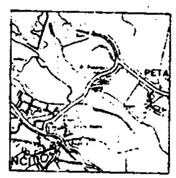
„0" VODOMERA IMA KOTO 193.363 m Base of water-level-gauge



SKICA



SITUACIJA 1:5000

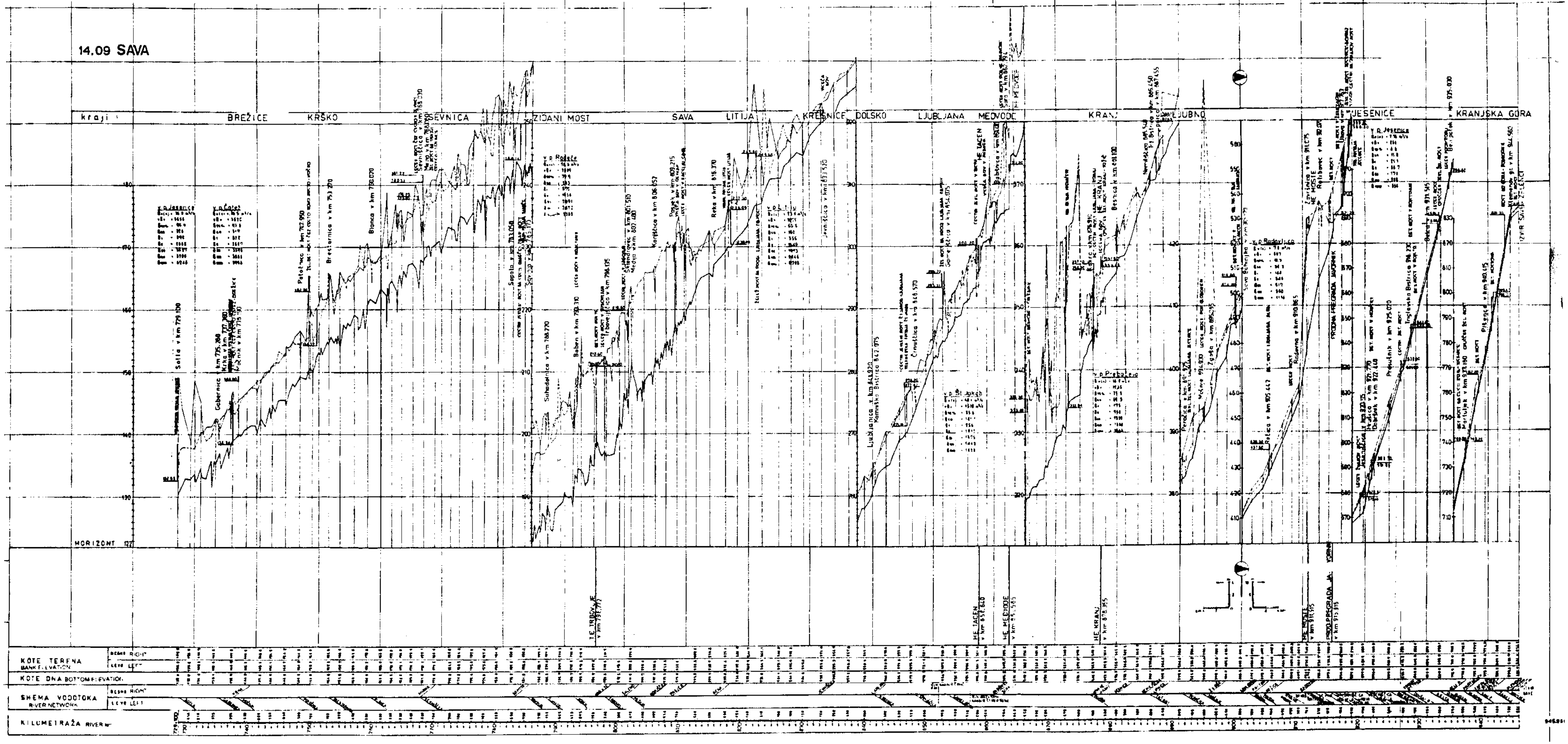


Annexes 4.4.3.-1 – 4.4.3.-3

The River Longitudinal-sections (gradients)

VZDOLŽNI PROFIL

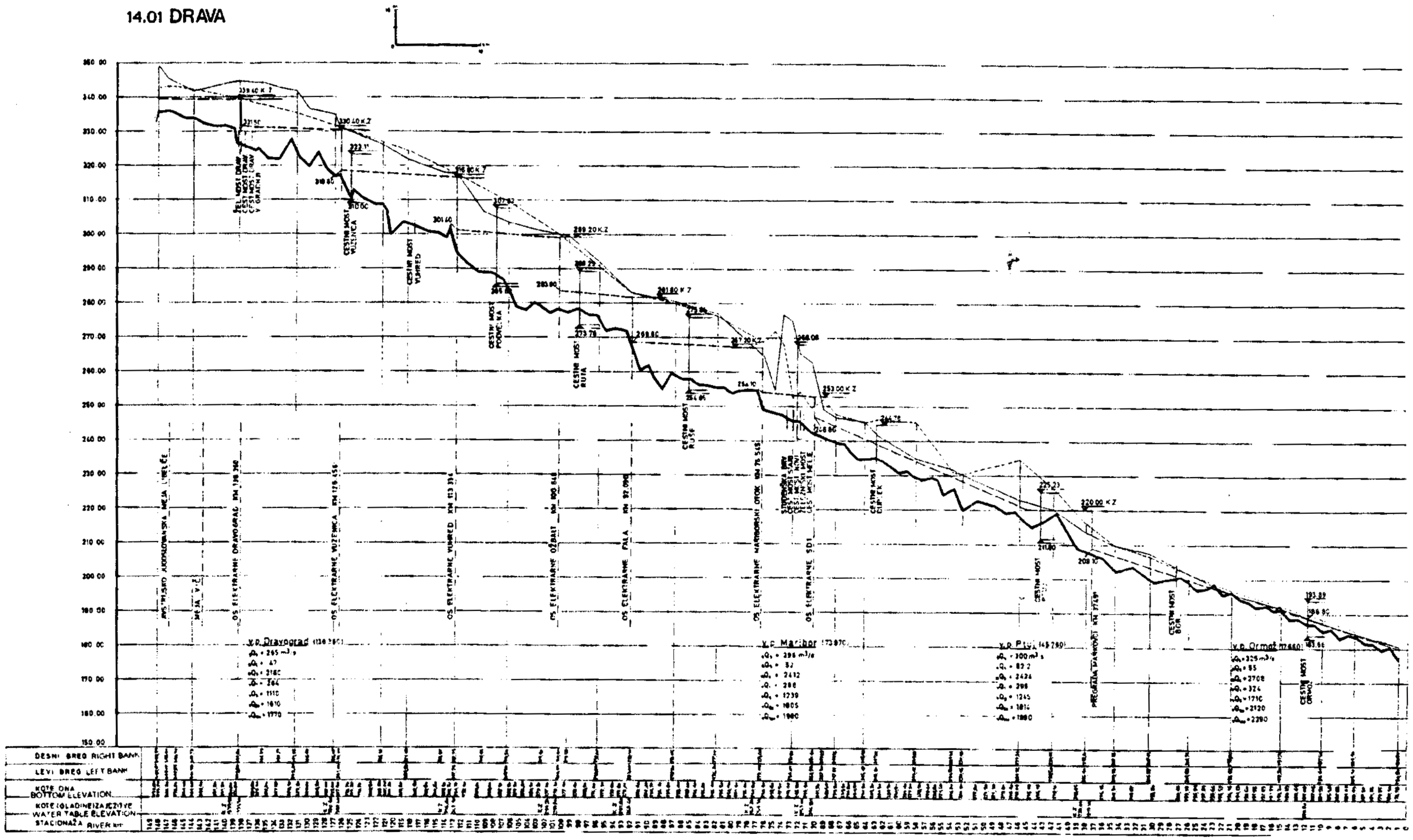
LONGITUDINAL PROFILE



VZDOLŽNI PROFIL

LONGITUDINAL PROFILE

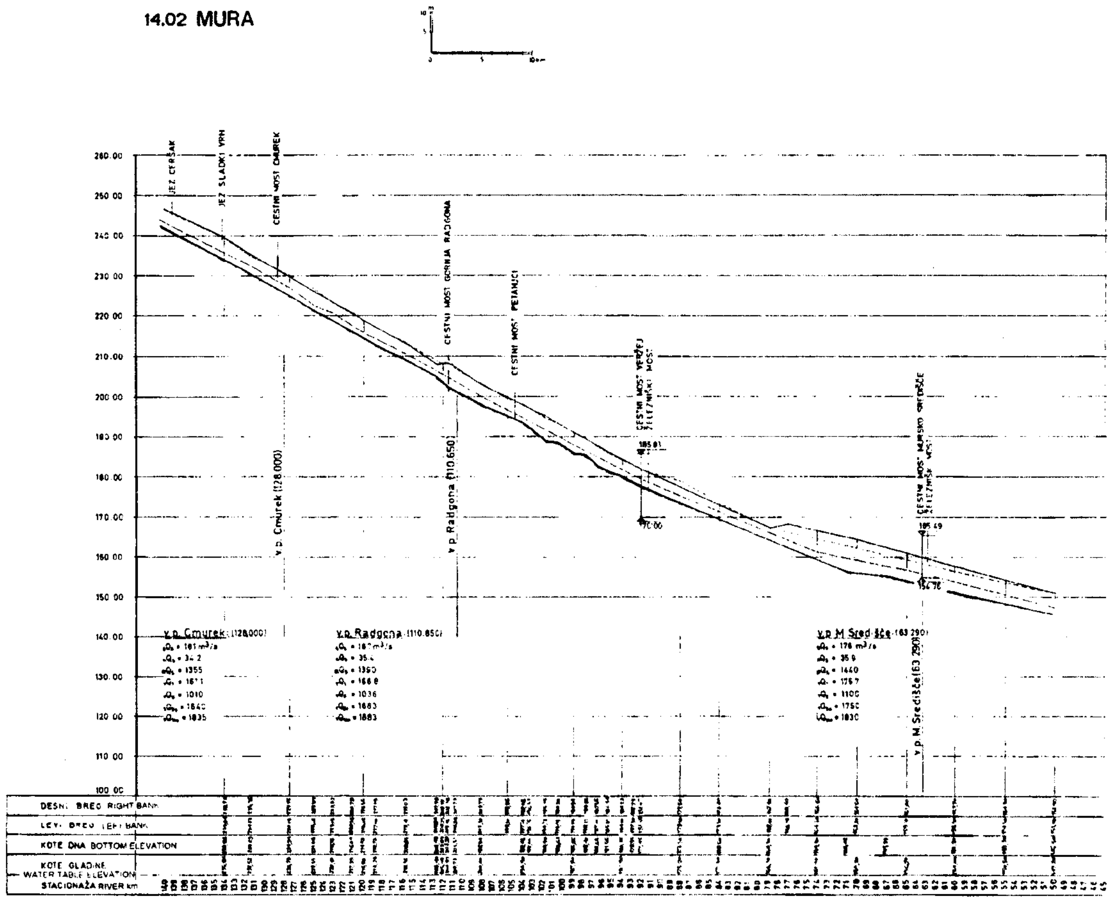
14.01 DRAVA



VZDOLŽNI PROFIL

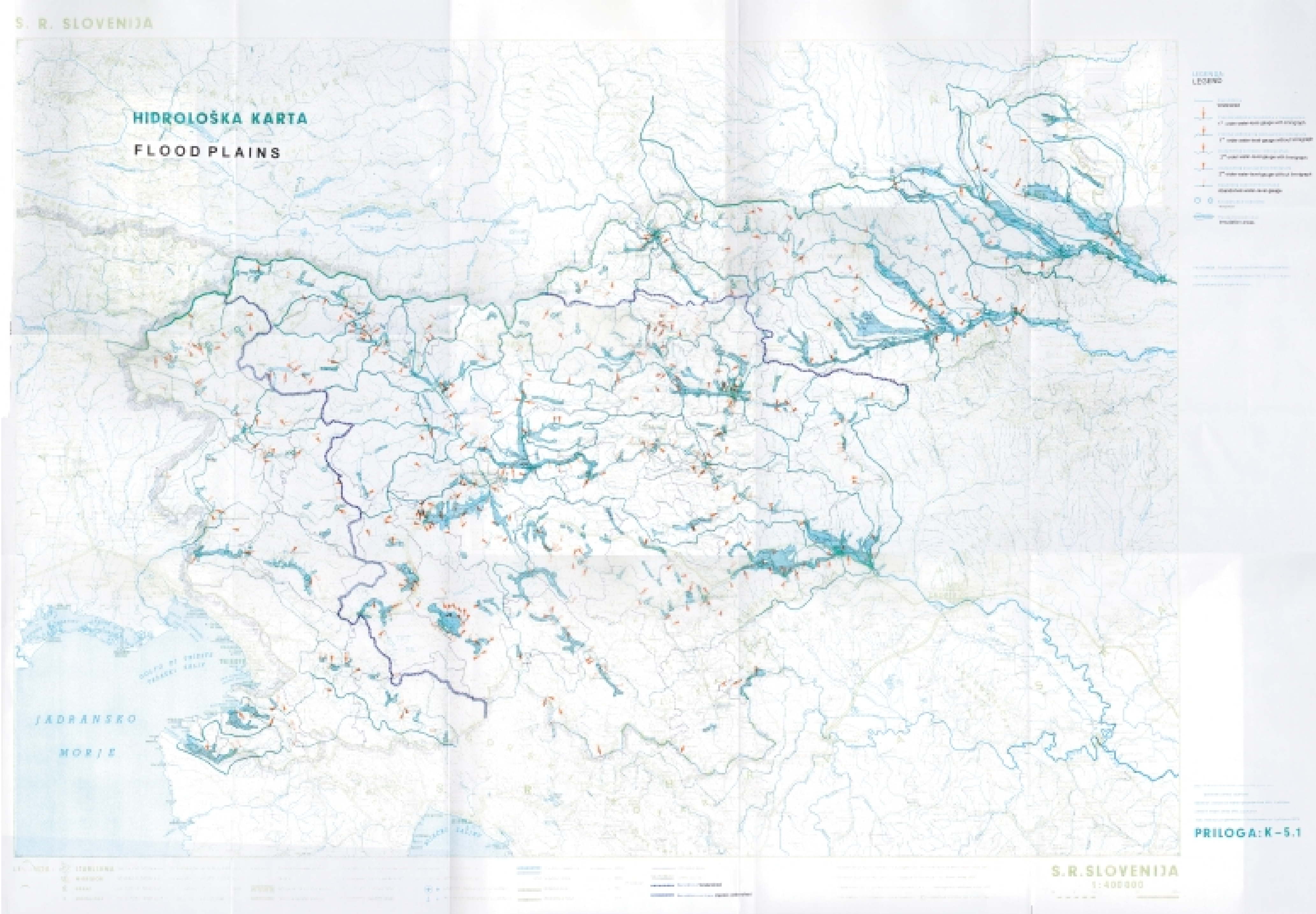
LONGITUDINAL PROFILE

14.02 MURA



Annex 4.4.4.-2

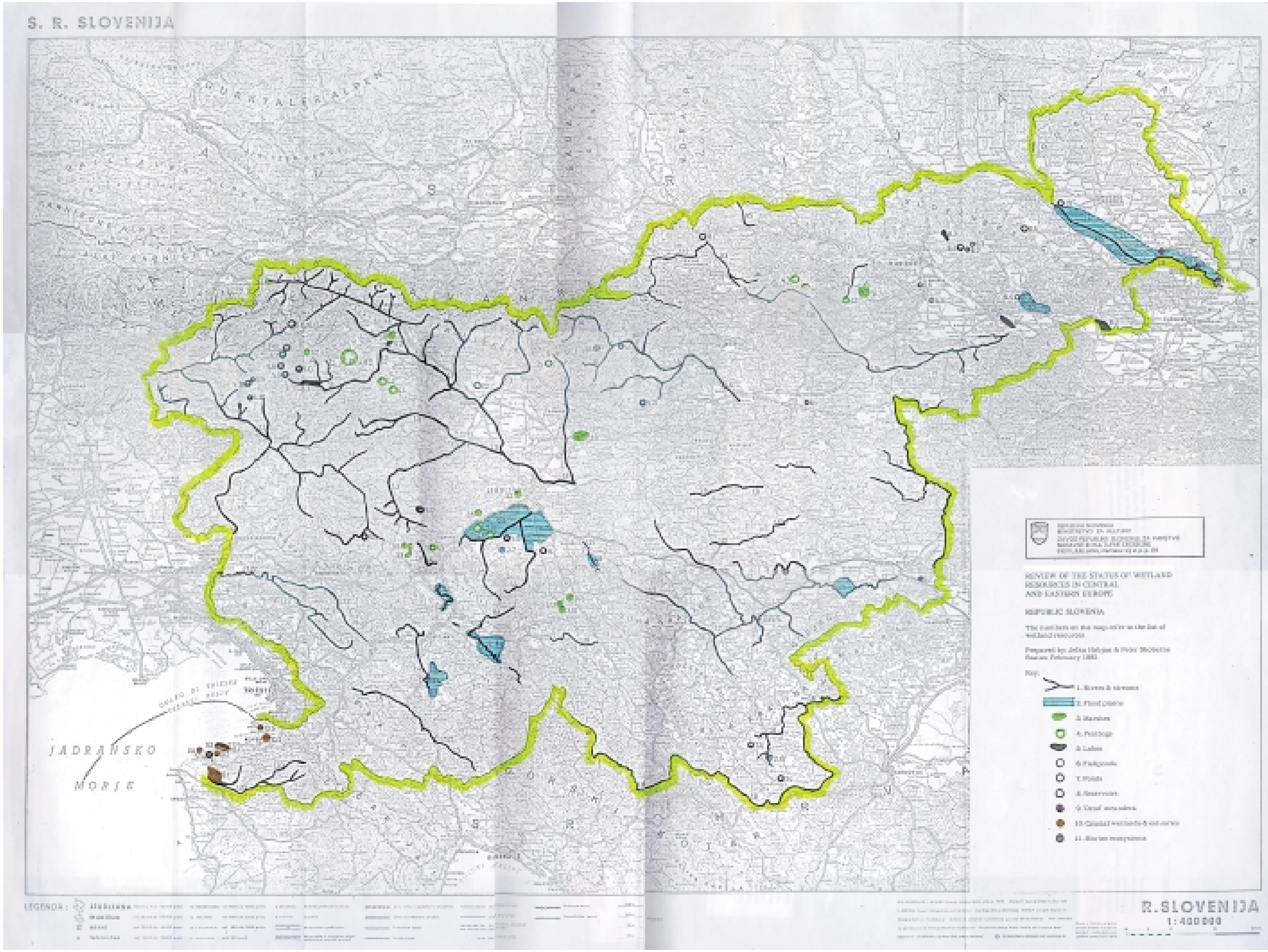
Map of Reservoirs and Floodplains
(Source VGI, 1976, Map K-5.1)



S. R. SLOVENIJA
HIDROLOŠKA KARTA
FLOOD PLAINS
LEGENDA
LEGEND
JADRANSKO
MORJE
PRILOGA: K-5.1
S.R.SLOVENIJA
1:400000

Annex 4.4.5.-1

Map of Major or Important Wetlands


S. R. SLOVENIJA
REVIEW OF THE STATUS OF WETLAND
RESOURCES IN CENTRAL
AND EASTERN EUROPE
REPUBLIC SLOVENIA
Key:
1. Rivers & streams
2. Flood plains
3. Marshes
4. Peat bogs
5. Lakes
6. Fishponds
7. Ponds
8. Reservoirs
JADRANSKO
MORJE
LEGENDA:
R. SLOVENIJA
1:400000

Annex 4.4.5.-2

Report on Slovenian Wetlands
(by P. Skoberne in 1992)

REVIEW OF THE STATUS OF WETLAND RESOURCES IN CENTRAL AND EASTERN EUROPE

REPUBLIC SLOVENIA

A. Description of wetland resources and their importance

The importance of wetland resources is presented by key words. The numbers refer to the locations on the map.

*** indicates international importance of the site.

rdb presence of plant or animal species included in the national red data lists

1. Rivers & streams

1.1. Soča - one of the five best preserved alpine rivers (ICALP report), biodiversity (mixing influences of mediterranean and alpine region, river alluvia, rdb, endemic trout *Salmo trutta fario*), ***

1.2. Nadiža - well preserved river

1.3. Sava - Upper parts, Sava Dolinka and Sava Bohinjka are well preserved, most important wet land: Zelenci, the source of Sava Dolinka (biodiversity, rdb)

1.4. Ljubljanica - seven sink rives forming unique karst system, biodiversity (greates number of hypogean taxons in the world, rdb, reed beds, flood plains, caves). Key localities: Cerkniško jezero, Planinsko polje, Postojnska jama, Planinska jama, Križna jama, Najdena jama, Logarček, Mačkovica), greatest known populations of endemic *Proteus anguinus*, ***

1.5. Reka - sink river, most important is the underwater system from Škocjanske jaem (World Heritage Site) to Devino (Devin) where are sources of Timav (Timao), rdb.

1.6. Savinja - well preserved alpine river (limestone)

1.7. Krka - lowland river with travertin

1.8. Kolpa - well preserved river, canyon, biodiversity (termophyll and illyric species on the northen border of distribution, rdb)

1.9. Sopota - well preserved stream

1.10. Mirna - well preserved stream

1.11. Sotla - well preserved stream

1.12. Meža - well preserved stream

1.13. Mislinja - well preserved stream

1.14. Lobnica - well preserved stream, metamorphic rocks, rdb

1.15. Mučka Bistrica - well preserved stream, rdb

1.16. Dravinja - well preserved stream

1.17. Gračnica - well preserved stream, rdb

1.18. Mura - low land river, pannonian influence, biodiversity (riparian flood forest, 'dead' meanders, rdb)

1.19. Ribnica (Dolenjska) - well preserved stream

1.20. Dragonja - river in flysh, mediterranean influence, rdb, key wet land: salt pans of Sečoveljske soline at the estuar (***)

1.21. Radenščica - sink river, flood plains

1.22. Vipava - mostly regulated, karst source

W

2. Flood plains

2.1. Murski logi - flood plains, riparian flood forest, rdb
2.2. Pesnica - flood plains, riparian flood forest, rdb
2.3. Cerkniško polje - flood plain, reed-beds, rdb, proposal for Ramsar site, ***
2.4. Pivška presihajoča jezera - flood plains
2.5. Krakovski gozd - flood forest, the last remnant of the low land Querceto forest in Slovenia, rdb
2.6. Planinsko polje - flood plain, rdb, outstanding scenic value
2.7. Ponikve pri Preserju - miniature karst polje (source, stream and sink hole on little distance)
2.8. Radensko polje - flood plain, rdb
2.9. Ljubljansko barje - partly regulated flood plain, proposal for Ramsar site, rdb
2.10. Nerajske Luge - flood plain

3. Marshes

All marshes are important for biodiversity because of specific ecological conditions. They are vulnerable to men activities. On all sites endangered plants have been recorded.

3.1. Bojtina na Pohorju
3.2. Rožnik - Večna pot
3.3. Zelena dolina pri Hotedrščici
3.4. Zelenci
3.5. Žejna dolina
3.6. Brezje pri Horjulu
3.7. Malo polje
3.8. Podhom pri Bledu
3.9. Češeniška gmajna
3.10. Logarji v Mišji dolini
3.11. Veliki log pri Raščici
3.12. Kaplanovo pri Velikih Laščah

4. Peatbogs

Raised or peat bogs in Slovenia are among the southest peat bogs in Europe.

4.1. Črno jezero na Pohorju
4.2. Lovrenško barje na Pohorju
4.3. Ribniško jezero na Pohorju
4.4. Jelovška barja
4.5. Jezerc
4.6. Goriški mah na Ljubljanskem barju
4.7. Kostanjevica na Ljubljanskem barju
4.8. Pokljuška barja

5. Lakes

Because of limestone alpine glacial lakes are relativly small in number and size. Special are karst periodic lakes, expecially well known is Cerkniško jezero, but they are classified in the group 2. (flood plains). Other types of the lakes are not of special importance, but because of their vulnerability mentioned in the list.

5.1. Jezero pri Jezerniku
5.2. Blejsko jezero - glacial lake

5.3. Bohinjsko jezero - glacial lake
5.4. Jezero pod Vršacem - high alpine lake
5.5. Zeleno jezero - high alpine lake
5.6. Rjavo jezero - high alpine lake
5.7. Jezero v Ledvici - high alpine lake
5.8. Dvojno jezero - high alpine lake
5.9. Črno jezero - high alpine lake
5.10. Jezero na Planini pri Jezeru - high alpine lake
5.11. Jezero pri Podpeči - karst lake
5.12. Račevsko jezero
5.13. Divje jezero - vouclise source type, rdb, ***
5.14. Jezerci v Fiesi - freshwater lake near Adriatic coast
5.15. Zgornje Kriško jezero - high alpine lake
5.16. Srednje Kriško jezero - high alpine lake
5.17. Spodnje Kriško jezero - high alpine lake
5.18. Krnsko jezero - high alpine lake
5.19. Dupeljsko jezero - high alpine lake
5.20. Jezero v Lužnici - high alpine lake
5.21. Biba na Menini planini

6. Fishponds

All mentioned fish ponds are importand as habitats of endangered plants and/or animals.

6.1. Blagovna
6.2. Hrastovec
6.3. Komarnik
6.4. Podvinci
6.5. Rače
6.6. Slivnica
6.7. Draga pri Igu

7. Ponds

All mentioned ponds are important as habitats of endangered plants and/or animals.

7.1. Zaton pri Petišovcih
7.2. Bobovek
7.3. Zjot
7.4. Gornji kal v Hrastu pri Vinici
7.5. Krvava lokev
7.6. Jezartica

8. Reservoirs

Important secundary habitats expecially for birds

8.1. Dravograjsko jezero
8.2. Ormoško jezero
8.3. Perniško jezero
8.4. Pristava
8.5. Negovsko jezero
8.6. Ptujsko jezero

9. 'Dead' meanders

The Mura river is the only law land river in Slovenia making a great number of meanders. Some of them lose contact with the river ('dead' meanders) and in very interesting succesion stages many endangered plants and animals occur. This wet land type is in close relation to riparian flood forests. There is great pannonian influence on the vegetation.

9.1. Hotiško jezero
9.2. Prilipe
9.3. Petišovsko jezero
9.4. Mrtvice ob Muri

10. Coastal wetlands & estuaries

10.1. Sečoveljske soline - partly still working, mostly abandoned salt pans. The abandoned part is extremly interesting because of halophytes, brakish fauna, ornitofavna (diversity of habitats, possibility for food, nesting and resting for migratory species), rdb, biodiversity, proposal for Ramsar site, ***

10.2. Strunjanske soline - partly abandoned salt pans in the lagoon, biodiversity (diversity of habitats, rdb)

10.3. Škocjanski zatok - seminatural estuar of Rižana river, halophytes, brakish favna, ornitofauna, rdb, ***

10.4. Strunjanski klif - flysh cliff, about 80 m high and about 2 km long; the biggest flysh cliff along the Adriatic coast, rdb, ***

10.4. Valdoltra - very endangered part of natural coast with endangered plants

11. Marine ecosystems

Two aquatories in the northern part of the Golf of Triest. Important for complex, transboundary protection of the Adriatic sea.

11.1. Piranska punta (aquatorium)
11.2. Strunjan aquatorium

II. Coverage and characteristic of wetlands included in Protected Areas

For each protected wetland, map ref., name and protection status are given:

1.1. Soča - natural monument (IUCN: III), upper part is included in the Triglav National Park; watershed protection, habitats protection

1.3. Sava - Upper part of Sava Bohinjka is included in the Triglav National Park; watershed protection

1.4. Ljubljanica - several parts of the river system are protected only, a new proposal is beeing made for more complex protection. Rakov Škocjan - landscape park (IUCN: V), Postojnska jama - natural monument (IUCN: III), Planinsko polje - landscape park (IUCN: V), Planinska jama - natural monument (IUCN: III)

1.5. Reka - sinking and explored undergorund area of this sinking river, protected within the system of Škocjanske jame as natural monument (IUCN: III). The site is inscribed in the UNESCO World Heritage List; watershed protection.

1.6. Savinja - partly protected in the upper part

1.7. Krka - partly protected as natural monument (IUCN: III); watershed protection

1.14. Lobnica - partly protected in nature reserve (IUCN: I); habitat protection

1.20. Dragonja - protected in landscape park (IUCN: V); watershed protection

2. Flood plains

2.5. Krakovski gozd - nature reserve (IUCN: V); habitat and species protection

2.6. Planinsko polje - partly protected as lanscape park (IUCN: V); habitat protection

2.10. Nerajske Luge - protected within landscape park (IUCN: V); habitat protection

3. Marshes

3.2. Rožnik nature reserve (IUCN: I); habitat and species protection

3.7. Malo polje - protected within the Triglav National Park; habitat protection

4. Peatbogs

Raised or peat bogs in Slovenia are among the southest peat bogs in Europe.

4.4. Jelovška barja - peat bog Ledina is protected as natural monument (IUCN: III); habitat and watershed protection

4.5. Jezerc - natural monument (IUCN: III); habitat and watershed protection

4.8. Pokljuška barja - protected within the Triglav National Park; habitat and watershed protection

5. Lakes

5.1. Jezero pri Jezerniku - natural monument (IUCN: III); watershed protection

5.2. Blejsko jezero - natural monument (IUCN: III); watershed protection

5.3. Bohinjsko jezero - protected within the Triglav National Park; watershed protection

5.4. Jezero pod Vršacem - protected within the Triglav National Park; watershed protection

5.5. Zeleno jezero - protected within the Triglav National Park; watershed protection

5.6. Rjavo jezero - protected within the Triglav National Park; watershed protection

5.7. Jezero v Ledvici - protected within the Triglav National Park; watershed protection

5.8. Dvojno jezero - protected within the Triglav National Park; watershed protection

5.9. Črno jezero - protected within the Triglav National Park; watershed protection

5.10. Jezero na Planini pri Jezeru - protected within the Triglav National Park; watershed protection

5.11. Jezero pri Podpeči - natural monument (IUCN: III); watershed protection

5.13. Divje jezero - natural monument (IUCN: III); watershed protection

5.15. Zgornje Kriško jezero - protected within the Triglav National Park; watershed protection

5.16. Srednje Kriško jezero - protected within the Triglav National Park; watershed protection

5.17. Spodnje Kriško jezero - protected within the Triglav National Park; watershed protection

5.18. Krnsko jezero - protected within the Triglav National Park; watershed protection

5.19. Dupeljsko jezero - protected within the Triglav National Park; watershed protection

5.20. Jezero v Lužnici - protected within the Triglav National Park; watershed protection

6. Fishponds

6.7. Draga pri Igu - natural monument (IUCN: III); watershed and habitat protection

7. Ponds

7.2. Bobovek - natural monument (IUCN: III); watershed and habitat protection

10. Coastal wetlands & estuaries

10.1. Sečoveljske soline - lanscape park (IUCN: V) with nature reserves (IUCN: I); watershed and habitat protection

10.2. Strunjanske soline - landscape park (IUCN: V); watershed and habitat protection

11. Marine ecosystems

Two aquatories in the northern part of the Golf of Triest. Important for complex, transboundary protection of the Adriatic sea.

11.1. Piranska punta (aquatorium) - natural monument (IUCN: III); habitat protection

11.2. Strunjan aquatorium - within landscape park (IUCN: V); habitat protection

III. Institutional arrangements for wetland management

There is no legal policy for complex wetland protection, nor for system like river basins or coastal area. For protected areas is responsible Ministery for culture on republic level and local communities on local level. No special management boards are established for managing protected wetlands. Unefficient management is one of the serious problems of protected wertlands.

Academy and University institutes are responsible for research activities, the role of NGO's in management or conservation of wetlands is of small importance at the moment. But we expect greater activities in this field in order to changes in legislation.

IV. Current activities on wetland conservation

In the new Slovene Nature Conservation Policy wetland conservation is of top priority. State Institute for Conservation of Natural and Cultural Heritage is preparing a proposal of new Conservation Act where habitat and species protection will be regulated including managing of protected areas and possibility to restore damaged areas.

They are coordinating a research on habitat mapping with special priority to wetlands. The result of this research will be a review of habitat types, a basement for evaluation of endangered habitats and conservation actions.

They are planning to enclude most important abd endangered wetlands in protected areas, and try to achieve complex protection of water systems.

In physical plan of Slovenia existing data about wetland areas are incorporated regardeless they are protected or not.

The goal of nature conservation is to achieve better coordination of nature conservation activities with water basin management planning and agriculture (drainage!).

V. Threats and pressures on wetland resources

Pollution

- global air pollution for isolated wetlands (like peat bogs)
- water pollution in general
- water pollution in karst river systems, expecially: law self cleaning possibilities, endangered high diversity of hipogean fauna, long range effect
- marine water pollution in the Golf of Trieste

Regulations of river beds

Some very tehnical (regardeless to nature) methods for flood prevention are still being used in Slovenia. That is a very serious threat to variety of habitats (and thus biodiversity) along the rivers. The side effect is lowering of underground water level.

Drainage

Many flood plains are endangered because of drainage fo agriculture reasons.

Hydro energy

Water gained energy is the purest but because our country is at the beggining of the rivers, we have reltively small water quantities. So for energetic exploatation are important high dams or great difference in height level. For nature conservation almost all hiroenergetic objects are hazardous, expecially greater reservoirs. At the moment power station on Sava is being built and they are existing plans for a dam on Soča tributary Učja and a system of power stations on Mura river. Problematically are even some small scale power stations, deriving water from a part of stream bed.

Unefficient legislation and management, combined with the lack of staff and insufficiently coordinated research work are threats on wetlands, too.

VI. Priorities for future management of wetland resources

- National policy for complex wetland conservation as a part of the Nature Conservation Policy
- changes in legislation
- efficient coordination in planning system
- using nature friendly methods for flood prevention
- prepare a survey of habitat types in Slovenia
- prepare a survey of endangered wetlands in Slovenia
- implementation of nature conservation ideas in water basin management
- new protected areas, covering wetlands
- signing Ramsar Convention and inscribe Sečoveljske soline, Ljubljansko barje and Cerkniško jezero in the list
- implement an efficient managing system for PAs
- to raise public awerness for importance of wetland protection

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Ljubljana, 10th March 1992

ADDITIONAL PROPOSALS FOR REVIEW OF THE STATUS OF
WETLAND RESOURCES IN C. & E. EUROPE
REPUBLIC SLOVENIA

	map ref.	habitat type	THREAT					
			Tour.	Energy	Ind.	Transp.	Agric.	Dom.
Zelenci	3.4	bog	T	n	n	T	P	n
		msh	T	n	n	T	P	n
Soča	1.1	riv	T	P	n	P	n	P
		gor	T	P	n	P	n	P
Planinsko polje	2.6	med	T	P	n	n	P	P
Krakovski gozd	2.5	for	n	n	n	P	T	n
Pohorska barja	4.1-3	bog	T	n	n	n	n	n
Jelovška barja	4.4	bog	T	n	n	n	n	n
Pokljuška barja	4.8	bog	T	n	n	n	P	n

Ljubljana, 11[th] Sept., 1992

Prepared by Peter Skoberne

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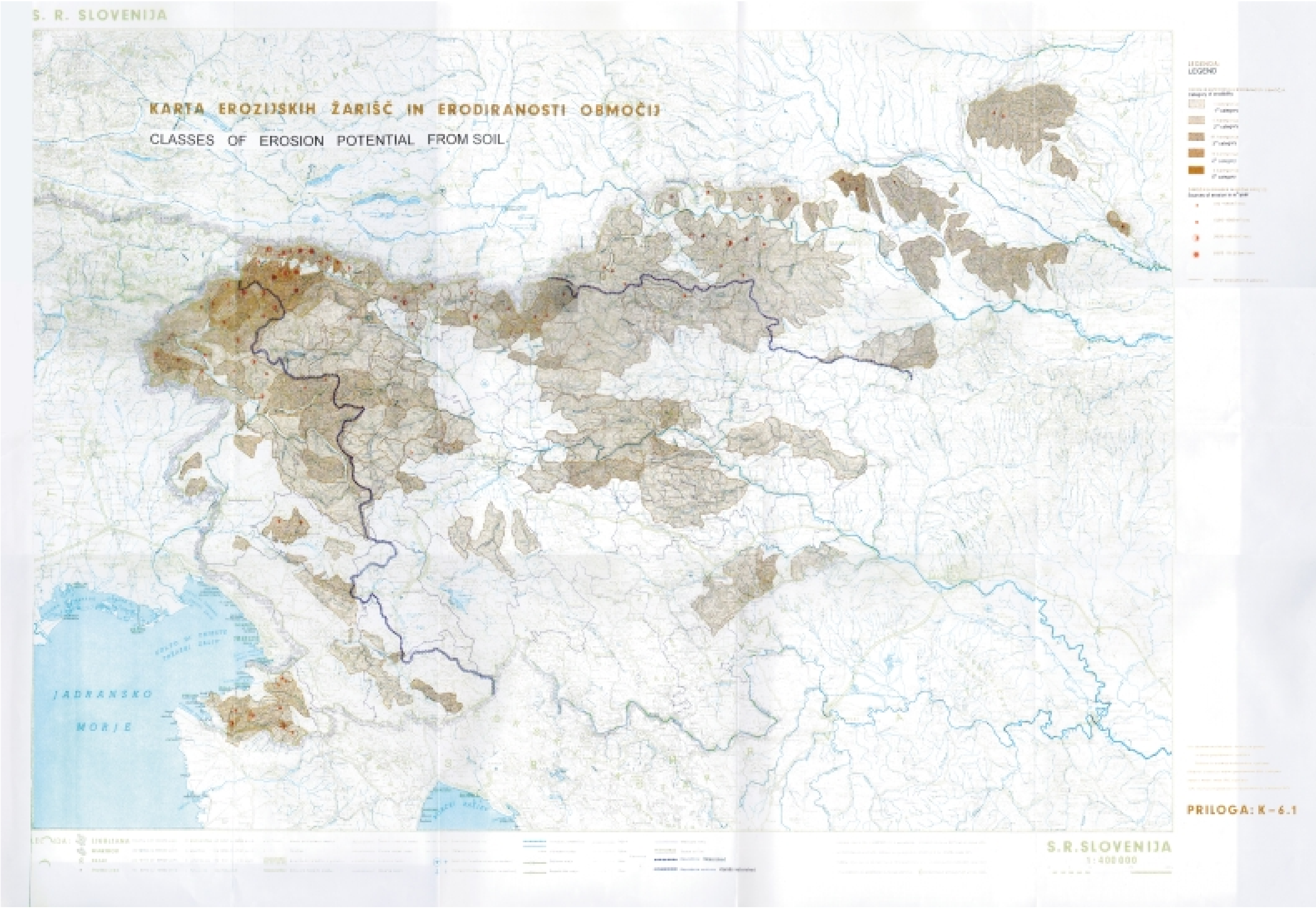
Annex 4.4.6.

Map of Erosion Sources
(VGI, 1976, Map K-6.1)


S. R. SLOVENIJA
KARTA EROZIJSKIH ŽARIŠČ IN ERODIRANOSTI OBMOČIJ
CLASSES OF EROSION POTENTIAL FROM SOIL
LEGENDA:
LEGEND
JADRANSKO
MORJE
PRILOGA: K – 6.1
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1:400000

Annex 4.5.-1

Map of Dams and Reservoirs
(VGI, 1976, Map K-11.1)


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IZRABA VODNIH MOČI IN PLOVBA
DAMS AND RESERVOIRS
LEGENDA
LEGEND
JADRANSKO
MORJE
I - II - III - IV
II - IV
PRILOGA: K – 11.1
S.R.SLOVENIJA
1 : 400 000

Annex 4.6.-1

Map Other Major Structures and Encroachments (VGI, 1976, Map K-7.1)

S. R. SLOVENIJA
VARSTVO PRED ŠKODLJIVIM DELOVANJEM VODA
MAJOR RIVER STRUCTURES AND ENSROACHMENTS
JADRANSKO
MORJE
PRILOGA: K-7.1
S.R.SLOVENIJA