

JAPAN INTERNATIONAL COOPERATION AGENCY

**SLOVAK ENVIRONMENTAL AGENCY
THE SLOVAK REPUBLIC**

**THE STUDY
ON
THE REGIONAL ENVIRONMENTAL MANAGEMENT PLAN
FOR
THE HRON RIVER BASIN
IN
THE SLOVAK REPUBLIC**

**Final Report
SUMMARY**

February 2000

**PACIFIC CONSULTANTS INTERNATIONAL, TOKYO
OYO CORPORATION, TOKYO**



Foreign Currency Exchange Rates Applied in the study

Currency	Exchange Rate / USD
Slovak Koruna (SKK)	41.358
Japanese Yen (JPY)	113.74

(Average rate of 1999)

PREFACE

In response to a request from the Government of the Slovak Republic, the Government of Japan decided to conduct a master plan study on the Regional Environmental Management Plan for the Hron River Basin and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA selected and dispatched a study team headed by Dr. Akira UCHIDA of Pacific Consultants International (PCI) and composed of PCI and Oyo Corporation to Slovakia three times between March 1998 and February 2000. In addition, JICA set up an advisory committee headed by Mr. Shigeru ANDO, Director, Office of Groundwater and Land Environment, Planning Division, Water Quality Bureau, Environment Agency between March 1998 and February 2000, which examined the study from specialist and technical points of view.

The team held discussions with the officials concerned of the Government of Slovakia and conducted field surveys at the study area. Upon returning to Japan, the team conducted further studies and prepared this final report.

I hope that this report will contribute to the promotion of this project and to the enhancement of friendly relationship between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of Slovakia for their close cooperation extended to the Team.

February 2000

A handwritten signature in black ink, appearing to read 'Kimio Fujita', written over a horizontal line.

Kimio Fujita
President

Japan International Cooperation Agency

MINISTERSTVO ŽIVOTNÉHO PROSTREDIA
SLOVENSKEJ REPUBLIKY

László MIKLÓS
minister

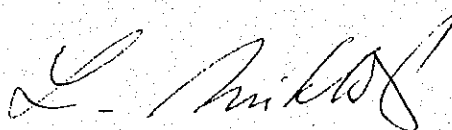
Bratislava January 19th, 2000

Dear Sirs,

The Ministry of the Environment of the Slovak Republic would like to thank hereby the Government of Japan for the comprehensive assistance with the Development Study on the Regional Environmental Management Plan for the Hron River Basin in the Slovak Republic. The output of this co-operation is the submitted Final Report that was successfully presented in the presence of the highest representatives of the Slovak Government and local self-governments on the state and regional level.

The Study was developed on the basis of the approved Memorandum of the Japanese Overseas Development Assistance to the Slovak Republic through the Japanese International Cooperation Agency by the International Study Team and I would like to express our sincere acknowledgement to everybody.

Yours sincerely



László Miklós
The Minister of the Environment

February 2000

Mr. Kimio Fujita
President
Japan International Cooperation Agency

LETTER OF TRANSMITTAL

Dear Sir,

We are pleased to submit to you the final report entitled "The Study on the Regional Environmental Management Plan for the Hron River Basin in the Slovak Republic." This report has been prepared by the Study Team in accordance with the contracts signed on 20 March 1998 and 28 April 1999 between the Japan International Cooperation Agency (JICA) and Pacific Consultants International (PCI).

The report describes the study results of developing the regional environmental management plan (REMP), a master plan for improvement of the environmental state of the Hron River Basin.

The report consists of the Main Report, Summary Report, Supporting Report and GIS Maps volume. The Main Report presents: i) the existing states of various environmental attributes to identify major environmental issues, ii) the REMF Core Plan with objectives and measures to tackle with those major environmental issues, and iii) Supporting Plans, as the common basis of promoting the Core Plan, which include improvements in institution, monitoring, environmental information system, environmental education and public participation. In addition, recommendations on financial strategy for the implementation of the REMF are also included. The Summary Report presents these results concisely. The Supporting Report includes detailed data concerning the existing environmental conditions and their analysis together with relevant existing plans and social and economic data to support reasoning of the plans and recommendations presented in the Main Report. The GIS Maps volume contains various environment related maps useful for the development of the REMF. These maps were prepared through extensive application of techniques of the geographic information system (GIS).

We wish to express grateful acknowledgements to the personnel of your Agency, Advisory Committee, Ministry of Foreign Affairs, Environment Agency, and Embassy of Japan in Prague. We also wish to express sincere appreciation to officials and individuals of the Slovak institutions concerned. We hope that the recommendations presented in this report will have a wide range of support by the people concerned with the environment of the Hron River Basin, and will be promoted for implementation to bring about the improvement of the environment.

Yours faithfully,

内田 顕

Dr. Akira UCHIDA
Team Leader

FRONTISPIECE

Extract from presentation by Peter Fowler entitled 'Cultural Landscape in Europe', given at the International Expert Meeting, Banska Stiavnica, Slovakia on 'Management Guidelines for Cultural Landscapes', 1 to 4 June 1999.

"Co-ordination: in some ways, this is the major European management challenge, especially in relation to size and scale. The problem is us, not the landscape; more specifically, in a continent relatively sophisticated in its governmental structure, the sheer complexity, inflexibility and often rivalry (not to mention occasional incompetence and corruption) within our bureaucratic hierarchies tend to place a large obstruction, rather than a facility, on the route to successful holistic management of large areas. Numerous authorities are likely to be involved because of the size, a huge and even disproportionate effort therefore being required to make the various bureaucratic parts function in any semblance of partnership."

"On Hadrian's Wall*, UK (not a Cultural Landscape but comparable in size and complexity), the breakthrough in management terms came not so much in the publication of a management plan (1996) but in the process of producing it. Over 2-3 years a motley, disparate and in part overtly hostile number of institutions and individuals sat down and threshed out a plan, of course a compromise but workable, and in the process they came not only to understand better the complexity with which they were dealing but also to realise that it was only by working together that they could best safeguard their own interests as well as, possibly, promote the sustainability of the whole area and its internationally-recognised resource".

* A very large, UNESCO-designated World Heritage Area in the north of England, stretching from the west to east coast and encompassing a defensive wall built in Roman times along the border with Scotland

FOREWORD

The Ministry of Environment, through the Slovak Environmental Agency (SAZP) and its other agencies and institutes, has a special responsibility and many duties to work with other organisations and the people of Slovakia to ensure a better environment for both present and future generations. This is an ambitious aim that involves both long and short term planning, the careful balancing of priorities and the wise use of resources. This will be made all the easier with the support and commitment of all those who use or manage the environment – the stakeholders.

As one way of helping the Slovak Environmental Agency to achieve this aim, an international Study Team, financed by the Japan International Cooperation Agency (JICA) and supported by a number of experts from Slovak institutions, has been developing a Regional Environmental Management Plan (REMP) for the Hron River Basin. This report is the Summary volume of the Final Report of the REMP.

A Main Report, Supporting Report and GIS Maps volume of A3 size have also been produced. The Supporting Report contains further details of the Study Area and of the data gathered during the course of the Study, the results of questionnaires and field investigations, planning and data analysis methodologies, etc. A Draft Final Report, consisting of a Summary in English and Slovak and three other volumes as above, was produced in November 1999 and circulated to interested parties. The Report was also presented to representatives of local and national governments, experts and others at meetings in Banská Bystrica and Bratislava in December 1999. A questionnaire, that invited comments and corrections, accompanied the Summary and both were publicly available through the Webpage of the SAZP. This Final Report takes into account the comments made on the Draft Final Report.

The feedback on the Draft Final Report has very much helped the Ministry of the Environment, the SAZP and the JICA Study Team, which has prepared the reports. The comments have provided general confirmation, from those familiar with the Basin and from technical specialists in the subjects covered, that the team, through its consultations and review and analysis of documents and databases, has identified major issues, has understood correctly the causes and has made recommendations that are reasonable.

The REMP describes some of the environmental problems faced in the Hron Basin, the activities that cause them and some of the development opportunities presented by the rich natural and cultural heritage of the area. A wide-ranging series of measures to address these problems and opportunities are then presented. Action on these recommendations will depend

very much on the support and co-operation both of the people, local government and industries of the Hron River Basin and of national government. With the interest of these stakeholders, it is hoped that some technical and financial support, for follow-up studies and for implementation of projects, may be forthcoming from international sources.

This is the first such plan for a River Basin in Slovakia. With the time and resources available to it, the Study Team has made the best use that it can of the data with which it has been provided; but the team is well aware that their analyses and interpretation are not perfect and that the REMP does not cover all the environmental issues that occur in the Basin. Nevertheless it is hoped that this REMP will provide a basis for environmental action in the Hron River Basin and be used as a model, to be developed and refined, in other basins and/or regions of Slovakia.

Despite the environmental degradation that the Basin has experienced, the Study Team believes that its environmental resources are rich and of great value to its inhabitants and others. The Hron River Basin is therefore worthy of sound management for present and future generations. A range of environmental management initiatives are already underway and the team hereby expresses its hope that these will continue and be complemented by new projects and programmes, so that the environmental issues in the Basin are addressed in a comprehensive manner.

ACKNOWLEDGEMENTS

The Study Team should like to take this opportunity to thank, for their co-operation and kindness during the course of the REMP Study, the many individuals and organisations who have provided assistance - they include state government and its agencies in Bratislava and in the *Kraj* and *Okres* of Banská Bystrica, Nitra and elsewhere in Slovakia; local self-government ie *Mesto* and *Obec*; non-government organisations; industry/private sector. These organisations and individuals, by providing information and through their patience in discussing ideas with an international team with little knowledge of Slovak, have made this study possible. The Study Team is especially grateful to the Steering Committee for their participation in the study and constructive comments, to SAZP for the provision of office space and technical and administrative assistance, and to the project's translators and interpreters for their language and communication skills, which helped to keep the Study Team in touch with the people of Slovakia and their writings. To all these institutions and individuals the team extend their gratitude for all the hospitality that they received. Finally, the Study Team thanks those who took the time and trouble to answer the various questionnaires that were circulated during the course of the study; the responses provided valuable information and feedback, which have helped to improve the content of the reports and demonstrated support for the majority of the recommendations.

The Study on the Regional Environmental Development Plan for the Hron River Basin

OUTLINES OF THE PROPOSED PLAN

(1) Planning Area

Hron River basin area: Most of the Banska Bystrica Kraj area and about a half of the Nitra Kraj area.

(2) Target Year

A target year for the whole plan is not specified. Proposed measures have their own target year.

(3) Content of the Proposed Plan

The REMP (Regional Environmental Management Plan) consists of the following major components.

- | | |
|-------------------|--|
| Core Plan: | Covering the following attributes of the environment: surface water, groundwater, soil, air, waste, ecology/forests, and heritage/tourism resources |
| Supporting Plans: | Covering the following aspects of the environmental management: institution, community participation and information dissemination, environmental education, environmental information network, and environmental monitoring |

The Core Plan identifies the major issues in each of the environmental attributes indicated above, and then set objectives and targets to tackle with those issues, and proposes specific measures to achieve the objectives and targets. The Supporting Plans are presented in similar manner in the Main and Summary Reports.

These issues and objectives, and the number of specific measures proposed in the Core Plan are summarised in the following table.

Environmental Issues and Objectives of the REMP Core Plan

Surface Water

GOAL: To improve surface water quality in the Hron River Basin, with all surface water for the Hron and its major tributaries attaining class III of the Slovak Water Quality Classification System (STN 75 7221), by 2010.

Issue	Objective	Measures
(SW1) Lack of concrete strategic objectives of water quality compatible with E.U directives	Development of water quality objectives to guide the management of the river	1 measure
(SW2) Domestic waste water treatment	Up-grade of sewerage systems coupled with the expansion of sewerage treatment plants and improvements in their operation to reduce BOD input into Hron	4 measures
(SW3) Industrial waste water treatment	To ensure proposed industrial plant effluents meet international and national standards.	2 measures
	Improvement of industrial wastewater quality from each existing industrial plant	3 measures
(SW4) Institutional and legal framework	Changes to legal framework to ensure improvement in industrial effluent quality	2 measures
	Improvement and /or development of sewerage treatment system	1 measure
	Interaction and data sharing between the many institutions involved in the water quality management of the Hron River Basin	1 measure

Soil and Groundwater

GOAL: To ensure that the quality of groundwater used for drinking and other purposes is in compliance with Slovak Standards, in order to protect human health and allow economic development of this resource on a sustainable basis.

Issue	Objective	Measures
(SG1) Information on quality of shallow groundwater incomplete and out of date	Provide an up-to-date definition of those areas, where groundwater is used for drinking, that do not comply with Slovak Standards for Drinking Water	1 measure
(SG2) Groundwater quality monitoring system inadequate (for detection of trends in vulnerable/contaminated areas used for drinking and other purposes)	Improve groundwater quality monitoring network and reporting system in those vulnerable areas where contamination has been identified	1 measure
(SG3) Some settlements/households not connected to safe drinking water supply	Determine Priority Areas for Upgrading Public Water Supply to meet Slovak Standards	1 measure
	To install Public Water Supply in Priority Areas	2 measures
(SG4) Suspected contamination of soil and groundwater with POPs	To determine the current condition of soil and groundwater with respect to contamination with POPs	1 measure
	As above and the prevention of further soil and groundwater contamination with POPs	1 measure
	The remediation of soil and groundwater contamination with POPs	1 measure
	The prevention of soil and groundwater contamination with POPs	1 measure
(SG5) Contamination of groundwater and soil in existing industrial areas and at old environmental loads (OEL)	Remediation of contaminated soil and groundwater in vulnerable areas and protection from further contamination	3 measures

Air

GOAL: To improve the ambient air quality in the Hron Basin so as to meet all the national air quality standards and for all stationary sources to comply with emission standards.

Issue	Objective	Measures
(A1) A number of plants are still not able to meet the emission standards	Reduction of pollutant emissions from stationary sources not complying with the emission standards	2 measures
(A2) The NO _x concentration exceeds the short-term air quality standards in the town of Banská Bystrica and heavy traffic roadside areas.	Reduction of ambient NO _x levels in the town of Banská Bystrica and heavy traffic roadside areas	6 measures
(A3) The TSP concentration exceeds the long-term air quality standard in certain areas in the town of Banská Bystrica.	Reduction of ambient dust levels in the town of Banská Bystrica	3 measures
(A4) The number of operable air quality monitoring stations is decreasing due to the budgetary shortage	To monitor any changes in the air quality that may have negative effects on the human health	2 measures

Waste

GOAL: To ensure that the methods and approaches adapted lead to the long term, effective management treatment, and disposal of solid waste within the Study Area, such that human health is safeguarded, but using the waste as a resource where possible

Issue	Objective	Measures
(W1.1) Waste Classification	To rationalise the waste classification system further, in order to simplify completion of the waste statistic forms	1 measure
(W1.2) Creation of Waste Statistics	To develop a waste-disposal based statistical record, removing double-accounting for waste production figures and placing the onus on data collection in the hands of the waste disposal operators	1 measure
(W1.3) Collation and Publication of Waste Statistics	To rationalise the collection, collation and presentation of waste disposal statistics, so that one organisation takes responsibility for the management of the data, even if another publishes the information	1 measure
(W2) Regional or Sub-regional Waste Plans	To develop a clear and quantified understanding of the future waste management requirements for the Study Area, either as a whole or on suitable sub-regional bases	1 measure
(W3) Old Environmental Loads	To develop a prioritisation for the reclamation or removal of OELs	1 measure
(W4) Medical Incinerator Operation	To provide safe, effective treatment of medical wastes	1 measure
(W5) Monitoring of Landfill Sites	To establish a comprehensive monitoring programme for all major landfill facilities and OELs, in order to identify significant environmental risks in the Study Area	1 measure
(W6) Alternative Waste Treatment	To improve public awareness with respect to waste recycling and improve industries adoption of waste minimisation, through educational programmes and realistic pricing mechanisms for waste disposal	1 measure
	To identify alternative methods of waste treatment and re-use	1 measure
(W7) Waste Transfer	To investigate the potential development of a rationalised waste handling and transport network within the Study Area	1 measure

Ecology

GOAL: To improve the management measures for ecology and biodiversity in major aquatic and terrestrial ecosystems of the Hron basin.

Issue	Objective	Measures
(E1) Forestry: ecologisation	Improve ecology and biodiversity in all forests	3 measures
(E2) Lower Hron valley: scarcity of protected areas and reduced biodiversity	Improved nature protection and conservation and landscape management	3 measures
(E3) Hron river and dependent habitats: impacts of river engineering	Use of knowledge gained from the past development of the Hron river for improving present and future management of the river and wetland habitats	2 measures
(E4) National Parks and Protected Landscape Areas: lack of management plans	Improved management for ecology and biodiversity	1 measure

Heritage and Tourism Resources

GOAL: The protection and improved management of major tourism and heritage resources as the basis for their sustainable use and economic development.

Issue	Objective	Measures
(H1) National parks and protected landscape areas: lack of tourism development plans	Improved management of tourism in NPs and PLAs	2 measures
(H2) Caves: lack of full protection	Improved protection and management of caves	2 measures
(H3) Hron river: poor microbiological water quality	Water quality suitable for all water contact sports	1 measure
(H4) Negative effects of economic change on listed monuments	Protection of Cultural Heritage from Negative effects of economic change	1 measure
	As above and to ensure consensus on the management proposals and priorities	2 measures
(H5) Deficiencies in institutional system and legislation for the protection of monuments	Improve decisions and actions by state and self-government administrators	1 measure
	To streamline and strengthen legislation and procedures for the protection of monuments	2 measures
	Stricter Monitoring and Enforcement of Conservation Consents	1 measure
(H6) Monument protection and development: resource and skill shortages	Increase the available funds for conservation	4 measures
	Ensure the conservation / integrity of the most Endangered Monuments	1 measure
	Promote tourism development within the basin	1 measure
	Improve the skills of state and local self-government employees, builders, developers etc involved in Monument Conservation	2 measures

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ABBREVIATIONS

CEEV	: Centre for Environmental Policy and Environmental Education, SAZP
CEHOVT	: Centre for Environmental Evaluation and Labelling, SAZP
COH	: Centre for Waste Management, SAZP
COKOO	: Centre for Revitalisation of Endangered Landscape Areas, SAZP
COKPD	: Centre for the Protection of Natural and Cultural Heritage
COPK	: Centre for Nature and Landscape Protection, SAZP
CUPER	: Centre for Physical Planning and Environmental Regionalisation, SAZP
GSSR	: Geological Survey of the Slovak Republic
ISZP	: Environmental Information System
JICA	: Japan International Cooperation Agency
LVU	: Forest Research Institute
MDPT	: Ministry of Transport, Posts and Telecommunications
MP	: Ministry of Agriculture
MZP	: Ministry of Environment
NGO	: Non-Government Organisation
PH	: Hron River Basin Authority (Povodie Hrona), a branch of SVP
REDISP	: Regional Development and Institutional Strengthening Project
SAD	: Bus Transport Agency
SAZP	: Slovak Environmental Agency
SFZP	: The State Environmental Fund
SHMU	: Slovak Hydrometeorological Institute
SIZP	: Slovak Environmental Inspectorate
StVak	: Central Slovak Water Supply and Sewerage Company
SVP	: Slovak Water Management Authority
SZU	: State Health Institute
VUDI	: Research Institute of Transport Engineering
VUPOP	: Soil Science and Conservation Research Institute
VUVH	: Slovak Water Research Institute
ZsVak	: Western Slovak Water Supply and Sewerage Company

CHAPTER 1

INTRODUCTION – THE STUDY AREA AND SCOPE OF STUDY

1.1 THE REMP PROJECT

The Hron River rises in the Low Tatra Mountains and flows through central Slovakia to the Danube. It has a total length of about 290 km, a catchment area of 5 465 km² with a population of around 500 000. In the basin, mineral mining and non-ferrous metal production industries have developed over several centuries. These industries have caused some pollution of soil, river water and groundwater, and deterioration of forests. During recent years, other pollution sources (factories, intensive agriculture, and domestic wastewater and solid waste) have been added.

The Slovak Government is considering further both the development of the Hron River Basin area and measures to preserve and improve its existing environment. Therefore, it recognizes the necessity of preparing a Regional Environmental Management Plan (REMP) for the basin.

The Japan International Cooperation Agency (JICA), in response to the request of the Slovak Government, undertook the preparation of the Regional Environmental Management Plan for the Hron River Basin. The work on the study has now been completed and feedback on the Draft Final Report (completed in November 1999 and presented in December to representatives of the River Basin at a meeting in Banska Bystrica and to representatives of government and potential donors in Bratislava) has been taken into account during the preparation of this Final Report.

The feedback on the report was generally constructive and positive. Most of the verbal responses at the meetings and the written responses to the questionnaire (which was circulated with the Summary of the Draft Final Report) demonstrated support for the majority of measures recommended in the REMP's Core Plan (Summary, Chapter 2) and in its Supporting Plans (Summary, Chapter 3). That a considerable effort was made to consult with a wide range of stakeholders during the course of the study, and that the recommendations of the Draft Final Report have received wide support, is good evidence that the REMP deserves the attention of the Government of the Slovak Republic, the private sector and international funding agencies and that efforts should be made to implement it in association with the citizens of the Basin.

1.2 STUDY AREA

The total catchment area is 11.1% of the total area (49 035 km²) of the Slovak Republic. The

Study Area (6 031km²) basically follows the natural catchment boundaries but it is adjusted according to cadaster boundaries. About 70% of the study area falls in the Banska Bystrica Kraj and 30% in the Nitra Kraj. All or part of 264 municipalities occur within the study area (Table S - 1). The Study Area and its constituent Okres are shown in Map S – 1.

Table S-1
Basic Population and Area Figures for Kraj and Okres within the Study Area.

Okres	Okres Totals			Study Area			% within Study Area	
	No. of O/M	Population (1996)	Area (km2)	No. of O/M	Population (1996)	Area (km2)	Population (1996)	Area (km2)
BANSKA BYSTRICA	42	112 926	809	42	112 926	809	100.0%	100.0%
BANSKA STIAVNICA	15	16 934	279	10	14 419	183	85.1%	65.6%
BREZNO	30	66 078	1 265	28	65 483	1 243	99.1%	98.3%
DETVA	15	34 014	445	12	32 541	343	95.7%	77.1%
REVUCA	42	40 900	730	1	1 123	103	2.7%	14.1%
ZARNOVICA	18	27 780	425	18	27 780	425	100.0%	100.0%
ZIAR NAD HRONOM	34	48 617	531	34	48 617	531	100.0%	100.0%
ZVOLEN *	26	67 955	761	24	67 469	584	99.3%	76.7%
Sub-total(BB Kraj)	222	415 204	5 245	169	370 358	4 221	89.2%	80.5%
LEVICE	89	121 163	1 550	63	98 952	1 133	81.7%	73.1%
NOVE ZAMKY	64	162 136	1 346	25	40 109	548	24.7%	40.7%
ZLATE MORAVCE *	33	43 612	521	7	8 204	129	18.8%	24.8%
Sub-total(Nitra Kraj)	186	326 911	3 417	95	147 265	1 810	45.0%	53.0%
Total	408	742 115	8 662	264	517 623	6 031	69.7%	69.6%

Total of Banska Bystrica Kraj	515	664 024	9 455	33%	56%	45%
Total of Nitra Kraj	347	717 585	6 343	27%	21%	29%
Total of two Kraj	862	1 381 609	15 798	31%	37%	38%

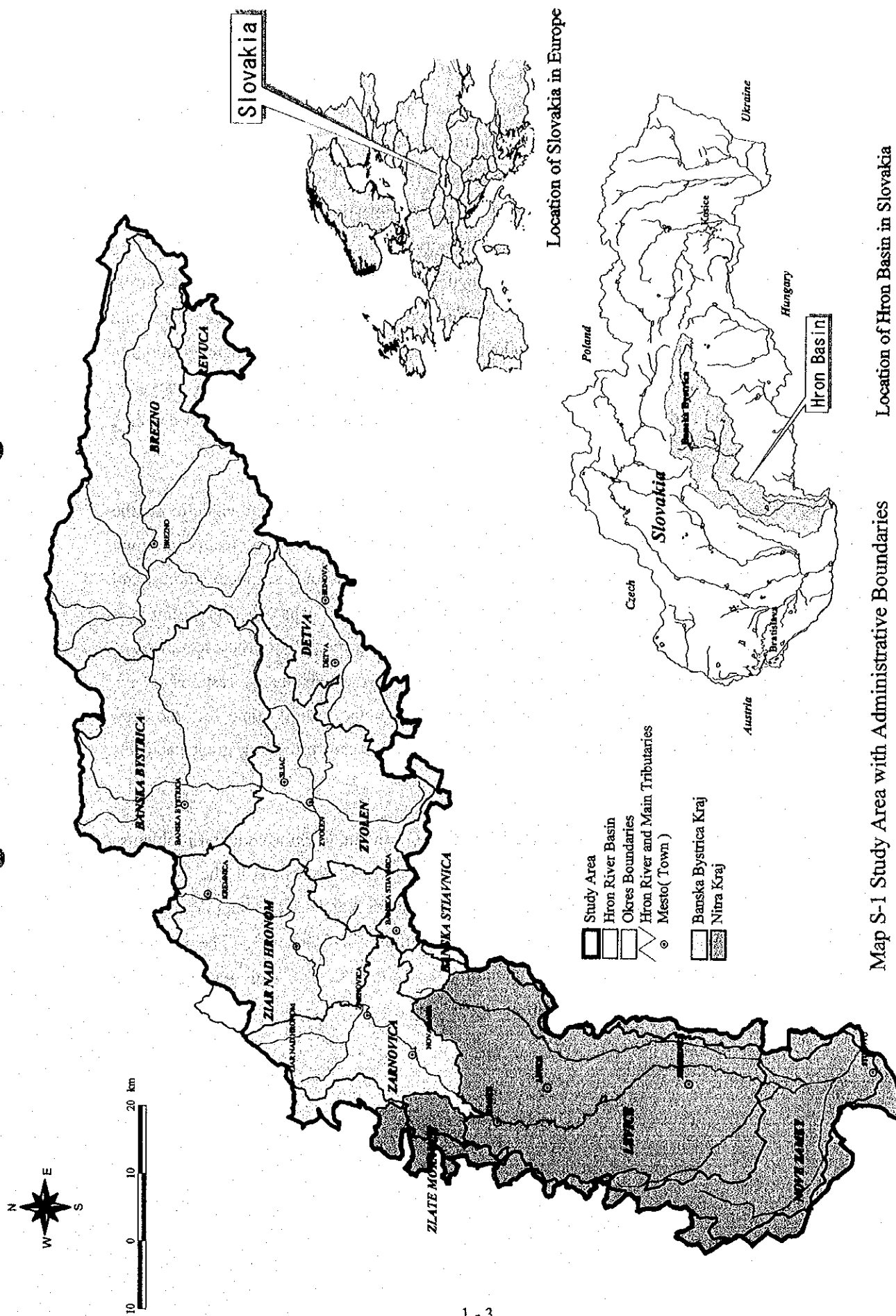
Note: * population data were calculated using the table provided in Main Report

O/M : Obec (village) / Mesto (town)

1.3 SCOPE OF STUDY

The main environmental aspects that the study has addressed are:

- Surface Water Quality
- Soil and Groundwater (especially their contamination status)
- Air Quality
- Waste Management
- Ecology and Biodiversity (including Forestry)
- Cultural Heritage (and Tourism)



Study Area (6 031 km²) basically follows the natural catchment boundaries but it is adjusted according to cadaster boundaries. About 70% of the study area falls in the Banska Bystrica Kraj and 30% in the Nitra Kraj. All or part of 264 municipalities occur within the study area (Table S - 1). The Study Area and its constituent Okres are shown in Map S – 1.

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BREZNO	30	66 078	1 265	28	65 483	1 243	99.1%	98.3%
DETVA	15	34 014	445	12	32 541	343	95.7%	77.1%
REVUCA	42	40 900	730	1	1 123	103	2.7%	14.1%
ZARNOVICA	18	27 780	425	18	27 780	425	100.0%	100.0%
ZIAR NAD HRONOM	34	48 617	531	34	48 617	531	100.0%	100.0%
ZVOLEN *	26	67 955	761	24	67 469	584	99.3%	76.7%
Sub-total(BB Kraj)	222	415 204	5 245	169	370 358	4 221	89.2%	80.5%
LEVICE	89	121 163	1 550	63	98 952	1 133	81.7%	73.1%
NOVE ZAMKY	64	162 136	1 346	25	40 109	548	24.7%	40.7%
ZLATE MORAVCE *	33	43 612	521	7	8 204	129	18.8%	24.8%
Sub-total(Nitra Kraj)	186	326 911	3 417	95	147 265	1 810	45.0%	53.0%
Total	408	742 115	8 662	264	517 623	6 031	69.7%	69.6%

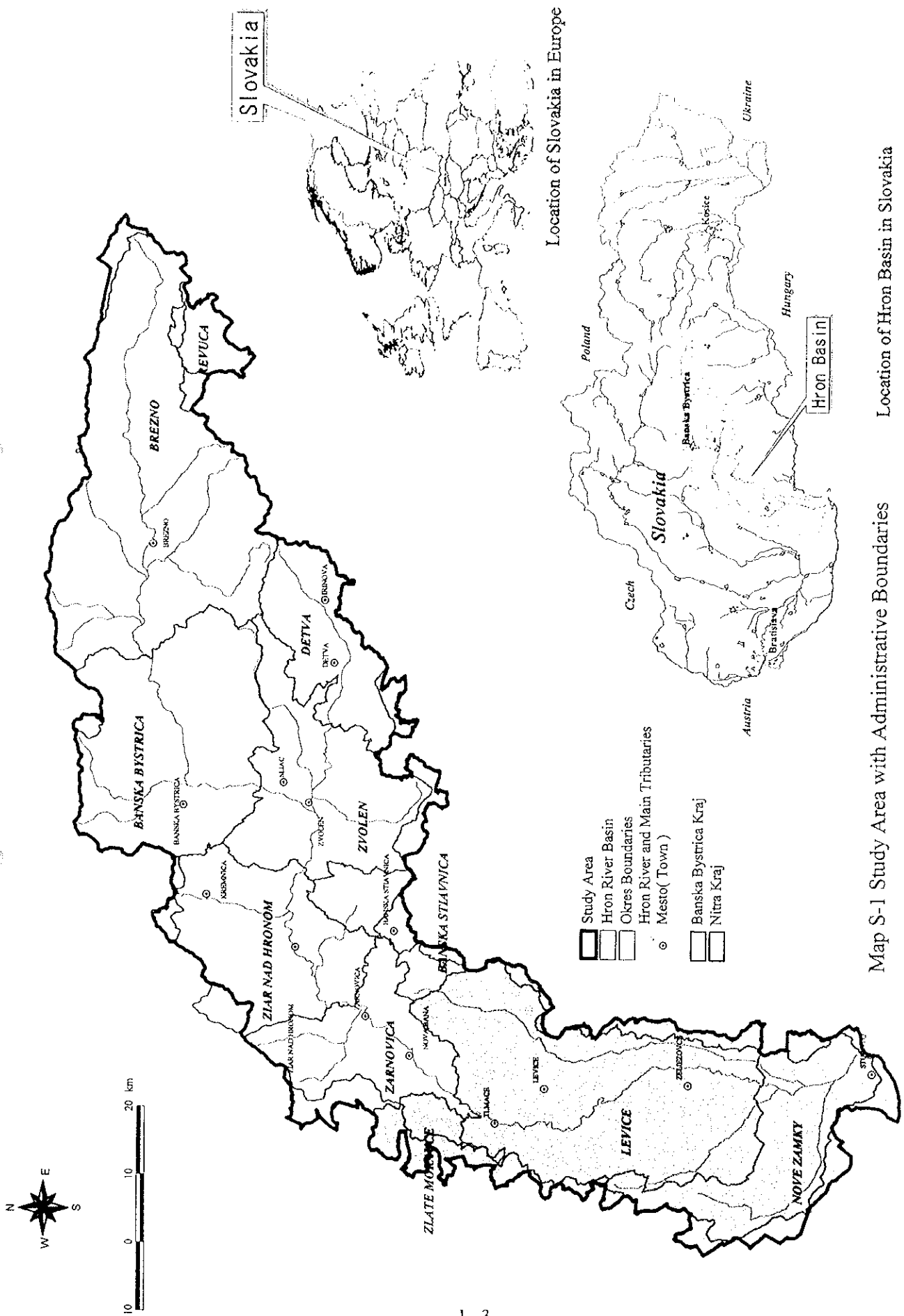
Total of Banska Bystrica Kraj	515	664 024	9 455	33%	56%	45%
Total of Nitra Kraj	347	717 585	6 343	27%	21%	29%
Total of two Kraj	862	1 381 609	15 798	31%	37%	38%

Note: * population data were calculated using the table provided in Main Report
O/M : Obec (village) / Mesto (town)

1.3 SCOPE OF STUDY

The main environmental aspects that the study has addressed are:

- Surface Water Quality
- Soil and Groundwater (especially their contamination status)
- Air Quality
- Waste Management
- Ecology and Biodiversity (including Forestry)
- Cultural Heritage (and Tourism)



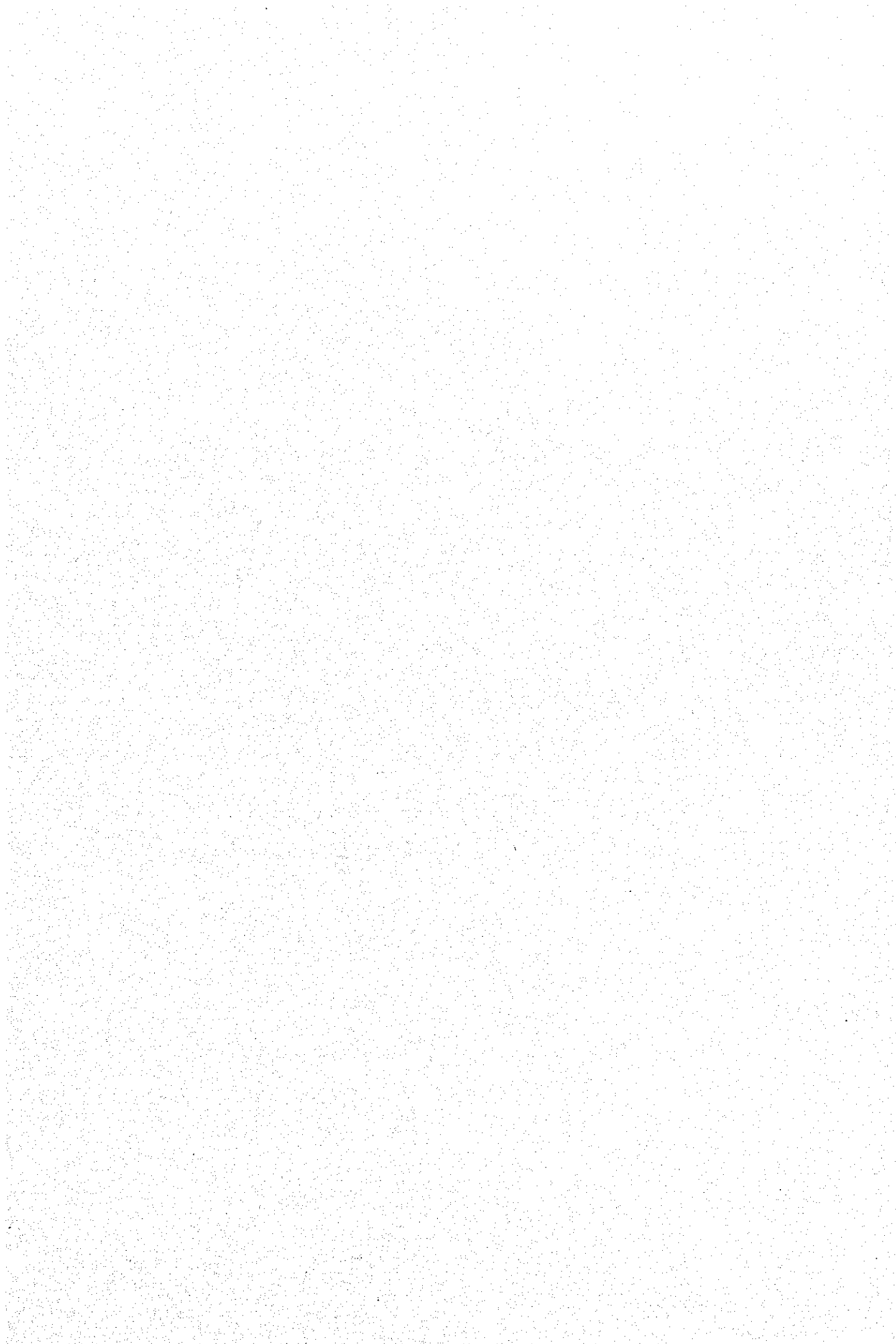
Map S-1 Study Area with Administrative Boundaries

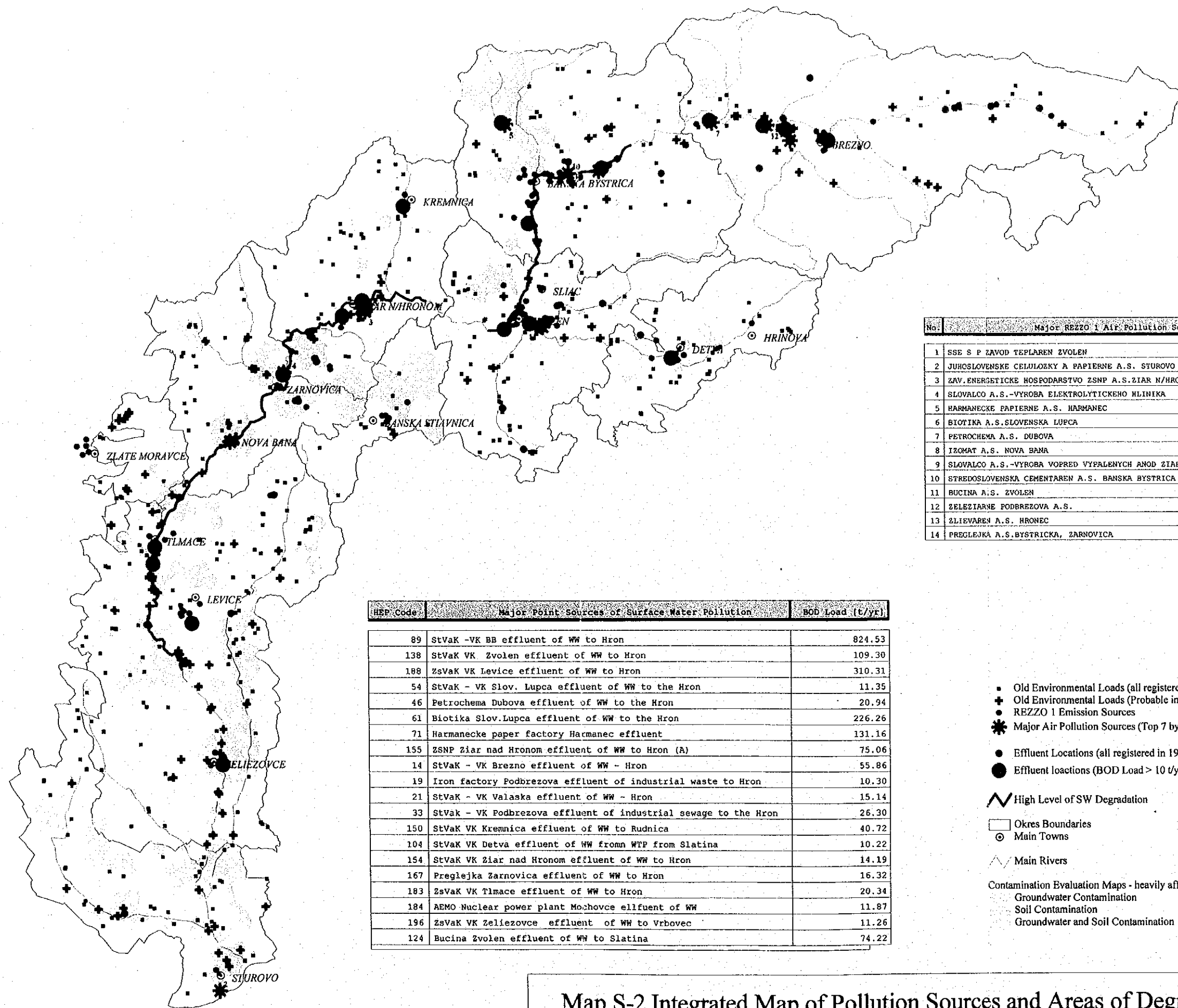
Data Source : SAZP , Map Prepared by JICA Study Team

A number of environmental topics have not been addressed because specialists in these subjects were not included in the Study Team and/or because information on the topics was not available. Large amounts of environmental data are in fact gathered in Slovakia, on a diverse range of topics and by numerous institutions, but some of this information is not readily shared. A big effort was made by the Study Team and the SAZP to identify, obtain and use relevant data beyond that provided by the organisations on the original Steering Committee. Some organisations were very co-operative, but some data could not be obtained at all and some arrived too late to be incorporated within the study. Aspects not covered by the study, or only touched on briefly, include hydraulic infrastructure (eg dams and reservoirs), renewable energy, noise, odour, health, radon risk, landscape restoration (especially of agricultural landscapes), physical impacts on the landscape (quarrying, erosion/landslides) and some elements of cultural heritage (eg folklore - traditional dancing, music, literature etc).

Though the Study Team have made a comprehensive set of recommendations, the recommended measures have not been elaborated in great detail, nor have project/programme costs been estimated. To do this is the work of pre-feasibility and/or investment studies, and requires close co-operation with those who know the local costs. The Steering Committee that was formally established to oversee the Project consisted principally of representatives of academic institutions and researchers/data gatherers, who were not directly responsible for environmental management. Lack of constructive contact with some of the key environmental managers has therefore prevented the Study Team providing great detail on these matters.

The Main and the Summary Reports of the REMP set out the main environmental problems, sector by sector. The overall strategy for presenting the REMP content is in the form of a Core Plan, a set of 'Core Measures' for each sector, in Chapter 2 and a set of Supporting Plans (consisting of a wide range of Measures and Programmes) in Chapter 3. The measures constitute a co-ordinated set of actions, including the further surveys and studies that are needed before proceeding to implementation.





No.	Major REZZO I Air Pollution Sources	Among Top 7 by
1	SSE S P ZAVOD TEPLAREN ZVOLEN	SO2 NOx
2	JUHOSLOVENSKE CELULOZKY A PAPIERNE A.S. STUROVO	SO2 NOx PM
3	ZAV.ENERGETICKE HOSPODARSTVO ZSNP A.S.ZIAR N/HRON	SO2 NOx PM
4	SLOVALCO A.S.-VYROBA ELEKTROLYTICKEHO HLINIKU	SO2 PM CO
5	HARMANECKE PAPIERNE A.S. HARMANEC	SO2 NOx
6	BIOTIKA A.S.SLOVENSKA LUPCA	SO2 NOx
7	PETROCHEMA A.S. DUBOVA	SO2 NOx PM
8	IZOMAT A.S. NOVA BANA	SO2 PM
9	SLOVALCO A.S.-VYROBA VOPRED VYPALENYCH ANOD ZIAR N/HRONOM	SO2
10	STREDOSLOVENSKA CEMENTAREN A.S. BANSKA BYSTRICA	SO2 NOx PM
11	BUCINA A.S. ZVOLEN	NOx PM
12	ZELEZIARNE PODBREZOVA A.S.	NOx
13	ZLIEVAREN A.S. HRONEC	PM
14	PREGLEJKA A.S.BYSTRICKA, ZARNOVICA	NOx PM

HEP Code	Major Point Sources of Surface Water Pollution	BOD Load (t/yr)
89	StVaK -VK BB effluent of WW to Hron	824.53
138	StVaK VK Zvolen effluent of WW to Hron	109.30
188	ZsVaK VK Levice effluent of WW to Hron	310.31
54	StVaK - VK Slov. Lupca effluent of WW to the Hron	11.35
46	Petrochema Dubova effluent of WW to the Hron	20.94
61	Biotika Slov.Lupca effluent of WW to the Hron	226.26
71	Harmanecke paper factory Harmanec effluent	131.16
155	ZSNP Ziar nad Hronom effluent of WW to Hron (A)	75.06
14	StVaK - VK Brezno effluent of WW - Hron	55.86
19	Iron factory Podbrezova effluent of industrial waste to Hron	10.30
21	StVaK - VK Valaska effluent of WW - Hron	15.14
33	StVaK - VK Podbrezova effluent of industrial sewage to the Hron	26.30
150	StVaK VK Kremnica effluent of WW to Rudnica	40.72
104	StVaK VK Detva effluent of WW fromn WTP from Slatina	10.22
154	StVaK VK Ziar nad Hronom effluent of WW to Hron	14.19
167	Preglejka Zarnovica effluent of WW to Hron	16.32
183	ZsVaK VK Tlmace effluent of WW to Hron	20.34
184	AEMO Nuclear power plant Mochovce effluent of WW	11.87
196	ZsVaK VK Zeliezovce effluent of WW to Vrbovec	11.26
124	Bucina Zvolen effluent of WW to Slatina	74.22

- Old Environmental Loads (all registered sites)
- + Old Environmental Loads (Probable impacts on SW or/and GW)
- + REZZO I Emission Sources
- * Major Air Pollution Sources (Top 7 by SO2, NOx and dust)
- Effluent Locations (all registered in 1999 by PH)
- Effluent locations (BOD Load > 10 t/yr) - Monitored by SHMU (1997 Data)

~ High Level of SW Degradation

- Okres Boundaries
- ⊙ Main Towns

~ Main Rivers

Contamination Evaluation Maps - heavily affected (5) and affected (4) areas
 Groundwater Contamination
 Soil Contamination
 Groundwater and Soil Contamination

Map S-2 Integrated Map of Pollution Sources and Areas of Degradation

Data Source: Counterpart Organisations (SHMU, GSSR) and Povodia Hrona
 Map Prepared by JICA Study Team



Targets have been set for the various measures, many in the form of specified environmental improvements by certain dates. The Study Team believes that the targets set are the desirable ones. However the Study Team also recognises that, for the targets to be met, rapid approval of the report and early provision of funding are necessary. Therefore, given the prevailing economic circumstances in Slovakia and that the REMP is a 'Pilot' plan without any pre-arranged source of finance for implementation, the Study Team accepts that the targets are ambitious and will be difficult to achieve and that they should be the subject of further discussion at a national and local level. However, it is believed that successful implementation of the various measures will help Slovakia to meet its EU accession requirements in the field of environment, and therefore that every effort should be made to achieve as many of the targets as possible.

The overall study approach is described further in the Main and Supporting Reports, but GIS and consultation techniques have been widely used, even though the latter were not formally designed into the REMP Study. The frontispiece shows how important consultations can be in the planning process and those conducted have proved helpful to the Study.

GIS techniques have been extensively used to analyse and present the data that has been obtained during the course of this study. Plots of these maps can be found in the Main, Supporting and Maps Volumes of this report. An integrated map of pollution sources and areas of degradation has been produced has been prepared using the GIS and is shown as Map S - 2.

The Summary concludes with a section, Chapter 4, on implementation and approaches to obtaining funding.

CHAPTER 2

THE REMP – CORE PLAN:

MAIN ISSUES AND PRIORITY TECHNICAL MEASURES

2.1 SURFACE WATER QUALITY AND ITS IMPROVEMENT

2.1.1 SUMMARY OF EXISTING STATE AND ISSUES

The state of surface water quality and pollution sources in the Study Area can be summarized as follows.

(1) Water quality

- a) Despite the fact that the Hron River has a considerable capacity for self-purification, its water quality, in general, is assessed to be polluted. This assessment is based on high values of microbiological pollution indicators, such as coliform bacteria, and to a lesser extent based on other organic and chemical/physical parameters, including heavy metals. Based on water quality data from 1996–1997 and the Slovak Classification of Surface Water Quality (STN 75 7221), the river water is considered suitable for limited purposes only.
- b) BOD₅ occurs at high concentrations, in excess of the permissible concentration of the Government Order No. 242/1993 Coll of Laws, between the Banska Bystrica area and the Zvolen area, due to industrial and urban sources of pollution.
- c) Heavy metal concentrations are, in general, at acceptable levels in the Hron River Basin, except around the Zarnovica area, where the concentration of zinc is relatively high, so as to fall into category IV of the Slovak Classification of Surface Water Quality (STN 75 7221).

(2) Major Water Pollution Sources – Domestic and Industrial

- a) Deficiency of wastewater treatment plants and inadequate treatment of domestic and industrial wastewaters in existing plants are considered to be the major causes of the pollution of the Hron River.
- b) The organic pollutant loads are comparatively high between the Banska Bystrica area and the Zvolen area where many of the major sources of pollution are concentrated.
- c) Municipal waste water effluents accounts for 70.1% of the recorded BOD load discharged in the Study Area. Among the municipal wastewater effluents, the BOD load of VK (Wastewater Treatment Plant, WTP) Banska Bystrica is the largest, at 38.1% of the total; in 1998 approximately 70% of the inflow of raw sewage to the WTP was said to receive mechanical-biological treatment only. Industrial wastewater effluents account for 28% of the total BOD load discharged. These sources are mostly located between the Banska Bystrica area and the Zvolen area. The largest pollution producer as for BOD₅ indicator among industries is BIOTIKA Slov. Lupca (10.5% of the total). Many wastewater treatment plants (industrial and municipal) are inadequate to meet the Government Order No.242/1993, which sets acceptable limits of pollutant concentration for the discharges.
- d) Although the above mentioned sources are major polluters among those being monitored, untreated domestic sewage discharges from areas that are not currently

monitored are an important, additional unrecorded source of surface water pollution. The Okres with a sewer connection rate lower than the national average (53.03%) and with high estimated potential BOD loads include Levice and Brezno. Okres with a sewer connection rate higher than the national average, but still having a high estimated total BOD production (because of high absolute population levels in those areas not yet connected to a sewage treatment system), include Banska Bystrica, Zvolen and Ziar nad Hronom.

(3) Water Quality Management – Institutional and Legal Issues

- a) Despite SHMU's central role in the monitoring of surface water quality in the Slovak Republic, it is difficult to obtain further information on the sources of pollution that SHMU are monitoring; such information is obtained and held by SVP, SIZP, Okres offices and the industries themselves. There are also several management plans/programmes (e.g. Hydro-Ecological Plans (HEP), Water Management Plans, NEAP. etc.) related to the water environment in the study area. An appropriate data/information management system might facilitate interactions between the many organizations involved in water quality management of the Hron River Basin.
- b) There is a lack of specific Water Quality Objectives for the Hron River. The Government Order No. 242/1993 set some 'permissible levels' for 'water management river' and 'other surface water', however this could be made more specific defining water quality objectives depending on how a particular stretch of water is to be used. For example different Water Quality Objectives could be set for canoeing, sailing and other contact recreation activities; fishing; industry (eg cooling water); irrigation.
- c) Due to a lack of budget, the number of SHMU surface water monitoring sampling sites in the Hron River Basin decreased from 27 in 1991, to 23 in 1997. In addition, only a limited number of parameters are monitored. It is necessary to share data, relevant to water quality management, collected by each organisation working within the Hron River Basin eg sharing of surface water and discharge/effluent data collected by StVak, PH, SHMU and SIZP.
- d) The legal system for pollution limits in surface water does not comply with E.U. directives and criteria by 2005. At present, it is necessary to enforce water quality improvements to comply with regulations such as the Government Order No. 242/1993.
- e) Larger industrial installations may not comply with E.U. I.P.P.C (Integrated Pollution Prevention and Control) Directive 96/61/EC. It is believed that most small and medium-sized industrial installations do not have Environmental Management Systems.

2.1.2 RECOMMENDED MEASURES

Table S-2 summaries the goal, objectives, targets, recommended measures and key agencies for improving surface water quality of the Hron River system.

For the improvement of the water quality in the Study Area, the following are recommended:

Water Quality Objectives

A programme should be set up to develop water quality objectives according to expected uses. For example, a certain stretch of the river may be proposed for recreational use. If this stretch of the river currently has a surface water quality of V, E3 (Coliform bacteria) and also falls into class V for nitrite, it is the coliform bacteria that are likely to cause the most harm to the user of this stretch of river. Therefore, it is most important for the water quality objectives to be focussed on the reduction of the amount of coliform bacteria, before it can be used for this purpose.

Domestic Wastewater Collection and Treatment

- a) To improve surface water quality, particularly relating to coliform bacteria, upgrading of sewerage systems, particularly those in areas between Banska Bystrica and Zvolen and at Levice is recommended. This should be coupled with the expansion of sewage treatment plants and improvements in their operation.
 - i) Ensure connection of all sewerage collectors to Waste Water Treatment Plants. Banska Bystrica and Levice already have approval from the Slovak Republic Government for this work.
 - ii) Carry out the expansion of existing wastewater treatment plants, particularly at Banska Bystrica and Levice.
 - iii) Continued development of sewerage systems in villages, towns and municipalities so that by 2005, 57% of inhabitants live in houses that are connected to public sewerage and treatment systems.
- b) To develop sewerage systems in towns and municipalities where the need is greatest, priority projects should be identified using transparent methods eg a decision-making system (see Annex N: CASE STUDY FOR THE PROJECT PRIORITISATION)
- c) A series of feasibility studies are recommended for those sub-catchments in rural areas where municipal sewerage systems are identified as a priority. These studies should seriously consider linking the sewerage systems of adjoining villages, in addition to using reed-beds (as a supporting method of biological methods) as a low cost means of treating rural/ municipal wastewater.

Industrial Wastewater Treatment

- d) Improvement of industrial wastewater treatment at each industrial plant, particularly for the removal of heavy metals, organics and other hazardous substances is recommended. When discharged directly to surface water, pollutants should be reduced so as to comply with the Government Order No.242/1993 and by 2005 with the EU Directive 91/271/EEC.
 - i) Risk assessment of industrial effluent could be used to determine ways of minimising the risk of adverse impacts to the River system from accidental or regular releases of industrial effluent (e.g. from a proposed factory). Information from this risk assessment could be used to minimise potential toxic pollutant releases, and reduce the risk of accidental release at source. Monitoring of effluent quality by the industries themselves to ensure compliance with standards should occur.

- ii) Reduction of pollutants discharged from Biotika Slovenska Lupca, through implementation of the project 'Ecologising Biotika' (document produced by Biotika). This involves the restructuring of Biotika's anaerobic WWTP and the repair of its sewer network.
- iii) Action should be taken at the Bucina Zvolen, to ensure that treatment of wastewater discharged into the Slatina is in compliance with standards.

Institutional and Legal

- e) Since the main costs for construction and operation of municipal sewerage systems must be borne by each municipality, a small municipality alone cannot meet such a requirement. Therefore, development of a practical institutional system is considered to be necessary, so that a sewerage system covering, for example, a few or several municipalities in a sub-basin of the Hron can be constructed and operated through the co-operation of those municipalities.
- f) The legal framework governing larger industrial plant's effluent discharges could be changed to ensure that these larger factories have to comply with the EU's IPPC (Integrated Pollution Prevention and Control) Directive 96/61/EC.
- g) Since IPPC only covers the larger industries, medium and small industries could establish Environmental Management Systems, certified under ISO 14001 for 50% of industries by 2005.
- h) A River Basin Management Board could be set up as a co-ordinating body in order to ensure and promote interactions and data sharing between the many institutions involved in the water quality management of the Hron River Basin (see section 3.1.3 recommendation IM2). This board could also meet to discuss and agree priority actions and investment programmes. This board could include representatives from: PH, StVaK, ZsVaK, SHMU, SIZP, State Health Institute, SAZP, Mesto, Kraj/Okres, NGOs and Industry Representatives. This would fit in well with the EU Framework Directive Water, which wishes to ensure 'the establishment of appropriate administrative arrangements, including the identification of the appropriate Competent Authority'.

2.2 SOIL AND GROUNDWATER AND THEIR IMPROVEMENT

2.2.1 SUMMARY OF EXISTING STATE OF SOIL AND GROUNDWATER

The situation concerning soil and ground water in the Study Area can be summarised as follows.

(1) Soil

- a) In the Lower Hron region, Chernozem, Fluvisol and Luvisol are the dominant soil types and most parts of this region are used for agriculture. Fertilizer consumption in the agricultural land was high in the past but it has decreased to the level of one third by now. In the middle to upper mountainous region, Cambisol and Rendzina are the dominant soil types and fluvisols can be found in the Hron Alluvial valley.
- b) In the geochemical atlas project, 660 soil samples were taken and tested between 1991 and 1995. The results have been analyzed and are shown on the soil evaluation map in the main report. Since then, soil monitoring, soil sampling and testing at a small number of locations (less than 30) has been conducted in the Study Area by VUPOP.
- c) The limit values of potentially toxic elements in the soil (hygienic limit values) for As, Cd, Cr, Cu, Ni, Pb and Zn are decided by the Resolution 531/1994. The evaluation of current soil condition in this report was mainly conducted by comparing this limit value with soil test results.
- d) Contaminated areas of soil are mainly distributed in the mountainous areas of the middle to upper region of the basin. Most of the areas are located in the surroundings of the old mining areas. As and Cu are the notable contaminants in this area. Furthermore, Ni, Pb, Hg, Zn and Cd exceed limits in some places. Mining activities and natural geochemical anomalies are the leading cause of this contamination.
- e) In the lower region, As and Cu contamination can be found in the Hron Alluvial valley. But the contamination is not so heavy and the area is limited.

(2) Groundwater

- a) In the geochemical atlas project, 1 965 groundwater samples were taken and tested between 1991 and 1994. For regular groundwater monitoring, 66 points for groundwater quality, 97 boreholes for groundwater level and 16 points for spring flow rate have been selected, with monitoring being conducted by SHMU. Further, additional 20 groundwater samples were taken in the most polluted parts of Levice district by GSSR. The analysis of the test will be completed by the end of 2000.
- b) The drinking water standard, Slovak standard STN 75 7111 is still applicable in Slovakia and the groundwater quality is mainly evaluated by comparing this standard and groundwater chemical test results.
- c) It is significant that the lower region of the Study area is widely contaminated. The main contaminants are NO₃, Ca and Total Dissolved Solids (TDS). Furthermore, areas heavily contaminated with these contaminants and with Cl and Mn can be found along the Hron Alluvial valley. This contamination in the lower region is attributed to agricultural activities, especially fertiliser use and possibly from OELs (Old Environmental Loads) at some locations. (Ref. to Map S – 2 and Map 7.5.4 of

the Main Report, Groundwater Pollution Thematic Map).

- d) In the middle region, two significant areas of contamination can be found. One is along the Hron Alluvial valley, where Fe, Al, As and Ca are the main contaminants. The concentration of factories and the accumulation of metal-rich sediments are the main causes of this contamination. The other contamination area consists of the surroundings of the old mining sites; Mn, Al, Ca, As and Cd are the main contaminants in this area. Mining activities are the main cause of this contamination
- e) Groundwater contamination in the upper region is relatively light compared with the other regions but Zn and Al contamination can be found in the mountain area. Old mining activities or natural geochemical anomalies are the causes of this contamination. NO₃ and NH₄ contamination can be found in the Hron Alluvial valley. Agricultural activity and sewage effluent is the cause of this contamination.
- f) Vulnerability analysis was conducted using the DRASTIC method. The contaminated areas of the alluvial valley and the lower region are in good agreement with the highly vulnerable areas as estimated by this vulnerability analysis.
- g) The reserves of groundwater are relatively stable. In the upper region, the average flow of spring is high and groundwater levels are slightly increasing. In the middle to lower region, the groundwater level is stable. The flow of the springs is stable in the middle region and slightly decreasing in the lower region. However, there are some karstic aquifers in the region where discharge changes very rapidly.
- h) The Public water supply (PWS) connection rate in Banská Bystrica Kraj part of the Study Area is relatively high at more than 90%. However, the PWS connection rate in Nitra kraj part of the Study Area is relatively low at around 70%. Most of the households which are not connected to the PWS use shallow groundwater from their own wells.
- i) Priority areas for improving the public water supply connection rate was studied based on the PWS connection rate, current groundwater quality, groundwater quality trends and physical vulnerability. From this result, Levice and Nove Zamky Okres are ranked of very high priority for the PWS connection rate improvement.

2.2.2 SOIL AND GROUNDWATER ISSUES, TARGETS AND RECOMMENDATIONS

Remediation of polluted soil and groundwater is not an easy task. Even when contaminated soil is limited to a small area, its remediation needs a very long time and a large cost, and the effect of the remediation may not be so reliable. Furthermore it is sometimes difficult to point out the definite cause of the pollution and to specify measures to eliminate the pollution source. Nevertheless, the main **goal** of environmental management in relation to soil and groundwater shall be the protection of human health against pollution. In other words, the issues of the utilisation of soil and groundwater shall be given high priority in the environmental management plan.

Although the overall soil and groundwater of the Study Area is not in a crucial state, there are localised problems or 'hot spots'. The following issues are identified as the major ones concerning soil and groundwater and recommendations are proposed to deal with these

issues. The recommended measures, objectives, targets and agencies with responsibilities for action are summarised in Table S - 2.

(SG1) Information on quality of shallow groundwater incomplete and out of date.

The geochemical atlas project for groundwater was conducted during 1991 – 1994. This is the most comprehensive groundwater study in the Study area. Groundwater monitoring has been conducted for many years by SHMU. Based on this information, endangered areas and vulnerable areas have been defined on maps in the Main Report. Their results are summarised in Map S – 2 of this Report.

However, more than 5 years has passed since the geochemical atlas project was conducted. Furthermore, the number of SHMU monitoring points is too small to understand the situation with respect to groundwater changes, especially since there are only a few points in the more vulnerable areas.

It is recommended to conduct a rapid assessment survey of groundwater quality by the end of 2000. The survey shall be conducted in those areas which are 'physically' vulnerable, because of the local hydrogeology, (Ref. to Figure 5.2.9), which are endangered/threatened (because contamination and or contamination sources have been identified (Ref. to Map Groundwater Evaluation Map) and where groundwater is utilized.

(SG2) Groundwater Quality Monitoring System

As described above, the number of groundwater monitoring points by SHMU is too small to understand groundwater quality trends correctly, especially in the high vulnerability area of the lower region. It can be recognized from the limited SHMU monitoring data that is available, that the contamination by NO₃ in groundwater in the lower region was highest in 1989 to 1991 and is gradually decreasing. However, because there are only a few monitoring points, it is very difficult to obtain a clear picture of groundwater quality changes in this lower Hron region.

The establishment of a sufficient number of monitoring points in the vulnerable areas is recommended. Additional monitoring points in Levice and Nove Zamky Okres are an urgent matter and it is recommended that they are established by the end of 2001. In other vulnerable/contaminated areas, it is recommended to establish new monitoring points by the end of 2002.

(SG3) Some Settlements/Households not connected to Safe Drinking Water Supply

In some parts of the Study area, especially in the lower region (Levice and Nove Zamky Okres) many settlements/households are not connected to a safe drinking water supply. The groundwater in this region is moderately to highly polluted and physical vulnerability to the pollution is generally high.

To supply clean drinking water for the settlements/households in the endangered and vulnerable areas, by the construction of public water supply, is recommended.

It is recommended to establish a local task force "Safe Drinking Water in the Hron Basin" by the end of 2000, to facilitate investigation of the issue and co-ordinate an action programme. Furthermore, a system to help determine priority areas for connection to a public water supply should be established.

The priority areas for installation of public water supply shall then be defined. A series of feasibility and detailed design studies for the priority areas should then be conducted, by the end of 2002 in Levice and Nove Zamky and by the end of 2003 elsewhere.

Based on these studies, water supply systems shall be constructed, with implementation by the end of 2003 in Levice and Nove Zamky and by the end of 2004 elsewhere.

(SG4) Suspected contamination of soil and groundwater with POPs

There is no comprehensive study, investigation or monitoring of contamination of soil and groundwater by POPs (Persistent Organic Pollutants). Nowadays POPs contamination is considered to be one of the most serious issues in developed countries in the field of soil and groundwater environment. There are few data for POPs contamination in the Study area, but a certain degree of POPs contamination may have occurred in the Hron alluvial valley, because factories are concentrated in this valley and the soil and groundwater are highly vulnerable to pollution. At least, it is expected that the POPs contamination may occur in the future in response to changes in industry.

To grasp the current condition of POPs contamination in the study area and to prepare measures for this type of contamination, it is recommended to conduct sampling and testing programmes for POPs in vulnerable areas by the end of 2002. Based on the results, endangered and vulnerable areas shall be defined and preparations for appropriate remediation should be made by the end of 2002. According to the severity of the problems identified, the remediation shall be conducted between 2003 to 2010.

As a basis for the above surveys and to prevent further POPs contamination of soil and groundwater, a survey/audit of industries and other potential sources of POPs shall be

conducted by the end of 2001. This would involve the checking of old maps, records etc to understand better the history of industrial development and activities at 'suspect' locations.

(SG5) Quality of soil and groundwater in polluted areas

Sites exist which have been heavily polluted, such as the old mining areas in Banská Štiavnica, the Soviet air base in Sliac, the environs of the aluminum factory in Ziar nad Hronom, etc. There have been detailed studies in some areas and only simple studies in others. The pollution may not be crucial at present for the health of people in the surrounding areas, but it should be realized that groundwater contamination proceeds slowly but continuously.

The study team could not collect enough information to judge the importance and urgency of pollution issues in these areas. However, the groundwater vulnerability of these areas is generally high. It is recommended to conduct further investigations and studies of soil and groundwater in these areas.

There is considerable, but 'patchy' information on the soil and groundwater condition in these areas. It is very difficult to determine those areas which are endangered, highly vulnerable and in need of urgent attention. First, it is recommended to conduct a comprehensive review of existing studies and databases on contaminated sites by the end of 2002. Based on this study, the endangered and vulnerable sites shall be selected. A site investigation programme and design studies for remediation and protection measures shall be conducted for these sites by the end of 2003. Execution of these remediation and protection programmes at the most vulnerable and endangered sites shall be conducted from 2003 to 2010.