TABLES

TABLE S.1.1 CATCHMENT AREA AND RIVER LENGTH OF THE BASINS

Number	River	Catchment area (km^2)	River length (km)
1.	**MARITZA MAIN STREAM**	**8323**	**305**
MU	Upstream Basin of the Main Stream	1602	103
MU1	Upper sub-basin	1173	30
MU2	Lower sub-basin	429	73
MM	Mid-stream Basin of the Main Stream	5087	136
MM1	Upper Sub-basin	1518	40
MM2	Middle sub-basin	1993	47
MM3	Lower sub-basin	1576	49
MD	Downstream Basin of the Main Stream	1634	66
2.	**MAJOR TRIBUTARIES**	**12991**	**873**
TOP	Topolnitza River (left tributary)	1857	129
LUD	Luda Yana River (left tributary)	739	73
PYA	Pyassachnik River (left tributary)	419	65
STR	Stryama River (left tributary)	1694	101
CPI	Chepinska River (right tributary)	919	75
STA	Stara River (right tributary)	366	54
VAC	Vacha River (right tributary)	1689	101
CPE	Chepelarska River (right tributary)	979	75
HAR	Harmanliyska River (right tributary)	986	81
SAZ	Sazliyka River (left tributary)	3343	119
	Total	**21314**	**1178**

TABLE S.2.1 PROPOSED MASTER PLAN FOR RIVER BASIN MANAGEMENT (1/2)

Management Plan		Zoning	Countermeasures	Project Cost (US$ 1000)	
				Structural Measures	Non-structural Measures
1.	**Water Quality Management**	**Priority region including priority towns for pollution control** Priority region: 1) Maritza Upstream 2) Maritza Mid-stream 3) Maritza Downstream Priority towns: 1) 1st priority towns: 7 towns 2) 2nd priority towns: 10 towns 3) 3rd priority towns: 19 towns	**(1) Construction of Domestic Wastewater Treatment Plants (WWTPs)** 1) 1st Stage Towns: 7 towns 2) 2nd Stage Towns: 10 towns 3) 3rd Stage Towns: 19 towns **(2) Regulation for Reduction of Pollution Load** 1) Industry (specially for top 20) 2) Animal breeding farms **(3) Strengthening of Monitoring System for Surface Water Quality**	**213,730** 122,021 36,437 55,272 -	 -
2.	**Water Resources Management**	**Water resources potential conservation and water demand control** 1) Zone I: For controlling water resources potential 2) Zone II: Medium of Zone I and Zone III 3) Zone III: For controlling water demand	**(1) Strengthening of Monitoring Systems** 1) Meteorology and hydrology 2) Water use facilities **(2) Rehabilitation of Water Supply Systems** 1) 1st stage system 2) 2nd stage system 3) 3rd stage system	 **119,815** 64,104 20,141 35,570	**360**
3.	**Land Use and Environmental Management**	**Land use categories and environmental sensitive areas** 1) Forest area 2) Agricultural area 3) Urban area 4) Conservation area 5) National parks and protection areas	**(1) Monitoring of Land Use and Natural Environment** 1) Land use 2) Natural environment		-
			Sub-total	**333,905**	**360**
			Grand total	**333,905**	

TABLE S.2.1 PROPOSED MASTER PLAN FOR RIVER BASIN MANAGEMENT (2/2)

Management Plan		Proposed Items
4.	**Further Development Studies and Investigations**	**(1) Development Studies** 1) Water resources management study in Bulgaria 2) Agricultural development study in the Maritza River Basin 3) Water balance study on hydropower systems 4) Study on groundwater management 5) Post-evaluation of the existing major river facilities **(2) Investigations** 1) Municipal water supply systems 2) Sewer systems of major urban centers 3) Industrial effluent 4) Mining sites for accidental pollution 5) Solid waste dumping sites 6) Biological monitoring
5.	**Institutional Structure Plan**	1) Establishment of River Basin Management Organization 2) Establishment of Project Implementation Unit (PIU) for supporting the River Basin Management Organization to implement large-scale project(s)
6.	**Phasing of the Master Plan**	Preparation Period : Year 1999 – Year 2000 Phase 1 : Year 2001 – 2005 Phase 2 : Year 2006 – 2010 Phase 3 : Year 2011 - 2015

Remarks:

1st stage towns for domestic wastewater treatment plants:

Pazardjik, Plovdiv, Assenovgrad, Haskovo, Dimitrovgrad, Stara Zagora and Velingrad

TABLE S.3.1 DESIGN CRITERIA FOR WWTP AND RELATED FACILITIES

Town	Pazardjik	Dimitirovgrad	StaraZagora	Notes
Design Population	97,000	61,000	165,000	
Design PE	97,000	61,000	165,000	
Total daily average flow	29,400 m3/day	18,800 m3/day	49,400 m3/day	250 l/person·day
Peak dry weather flow: Qdwf	45,600 m3/day	30,200 m3/day	73,800 m3/day	
Peak wet weather flow: Qwwf(2*Qdwf)	91,200 m3/day	60,400 m3/day	147,600 m3/day	
BOD load	5,240 kg/day	3,300 kg/day	8,890 kg/day	54 g/person·day
SS load	6,310 kg/day	3,980 kg/day	10,700 kg/day	65 g/person·day
Related facilities				
main collector	new φ1.3 L= 2,640	existing φ1.0	existing 2.0*2.0	
over flow chamber	new biginning point of new main collector	existing end of existing main collector	new inside WWTP	
WWTP				
site area	10.8 ha	6.4 ha	11.4 ha	
process	conventional activated sludge process	extended aeration process	conventional activated sludge process	
WWTP main facilities				
screening , grit removal	○	○	○	coarse&fine
oil removal	○	○	○	
primary sedimentation tanks	○		○	hydraulic surface load 50 m3/m2·day
aeration tanks	○	○	○	HRT 9hrs (CAS) HRT 24hrs (ExA)
final sedimentation tanks	○	○	○	hydraulic surface load 20 m3/m2·day (CAS) 8 m3/m2·day (ExA)
disinfection (emergency)	○	○	○	HRT 30 min
sludge gravity thickening	○	○	○	surface loading rate 60 kg-ds/m2·day
sludge digestion	○		○	retention period 30 days
gas tanks	○		○	storage for 12 hrs
dewatering equipment (belt press)	○	○	○	sludge loading rate 100 kg-ds/m·hr
sludge drying bed(stand-by)	○	○	○	
control building	○	○	○	
sludge dewatering building	○	○	○	
other buildings	○	○	○	

TABLE S.3.2 SUMMARY OF FINANCIAL AND ECONOMIC ANALYSIS

1. PAZARDJIK WWTP PROJECT

1-1 FINANCIAL AND ECONOMIC ANALYSIS OF CASES

Case No.	Initial User charge (Lv./m3)	Positive financial balance		FIRR	EIRR	Remarks
		Annual	Cumulative			
Case 1	350	From 15th year	From 33th year	#DIV/0!	#NUM!	Annual increase of user charge
Case 2	400	From 14th year	From 24th year	#NUM!	3.67%	ditto
Case 3	450	From 12th year	From 19th year	3.35%	5.19%	ditto
Case 4	500	From 10th year	From 15th year	4.74%	6.55%	ditto
Case 5	550	From 9th year	From 13th year	5.99%	7.80%	ditto
Case 6	600	From 6th year	From 10th year	7.14%	8.96%	ditto
Case 7	650	From 5th year	From 7th year	8.21%	10.06%	ditto
Case 8	700	From 4th year	From 5th year	9.23%	11.11%	ditto

1-2 SENSITIVITY ANALYSIS

Case No.	Initial User charge (Lv./m3)	Positive financial balance		FIRR	EIRR	Remarks
		Annual	Cumulative			
Case 5-1	550	From 10th year	From 14th year	5.38%	7.09%	Capital cost x 1.1
Case 5-2	550	From 11th year	From 18th year	4.36%	6.29%	O&M cost x 1.2

2. DIMITROVGRAD WWTP PROJECT

2-1 FINANCIAL AND ECONOMIC ANALYSIS OF CASES

Case No.	Initial User charge (Lv./m3)	Positive financial balance		FIRR	EIRR	Remarks
		Annual	Cumulative			
Case 1	250	From 11th year	From 16th year	1.85%	3.31%	Annual increase of user charge
Case 2	300	From 9th year	From 9th year	3.87%	5.26%	ditto
Case 3	350	From 3rd year	From 4th year	5.55%	6.93%	ditto
Case 4	400	From 3rd year	From 3rd year	7.02%	8.42%	ditto
Case 5	450	From 3rd year	From 3rd year	8.35%	9.79%	ditto
Case 6	500	From 3rd year	From 3rd year	9.58%	11.07%	ditto
Case 7	550	From 3rd year	From 3rd year	10.74%	12.28%	ditto
Case 8	600	From 3rd year	From 3rd year	11.84%	13.44%	ditto

2-2 SENSITIVITY ANALYSIS

Case No.	Initial User charge (Lv./m3)	Positive financial balance		FIRR	EIRR	Remarks
		Annual	Cumulative			
Case 4-1	400	From 3rd year	From 3rd year	6.35%	7.70%	Capital cost x 1.1
Case 4-2	400	From 3rd year	From 4th year	6.20%	7.68%	O&M cost x 1.2

3. STARA ZAGORA WWTP PROJECT

3-1 FINANCIAL AND ECONOMIC ANALYSIS OF CASES

Case No.	Initial User charge (Lv./m3)	Positive financial balance		FIRR	EIRR	Remarks
		Annual	Cumulative			
Case 1	250	From 15th year	From 29th year	#NUM!	2.44%	Annual increase of user charge
Case 2	300	From 12th year	From 19th year	2.99%	4.91%	ditto
Case 3	350	From 10th year	From 14th year	5.11%	6.97%	ditto
Case 4	400	From 6th year	From 9th year	6.93%	8.81%	ditto
Case 5	450	From 4th year	From 4th year	8.57%	10.49%	ditto
Case 6	500	From 3rd year	From 3rd year	10.09%	12.08%	ditto
Case 7	550	From 3rd year	From 3rd year	11.52%	13.59%	ditto
Case 8	600	From 3rd year	From 3rd year	12.90%	15.04%	ditto

3-2 SENSITIVITY ANALYSIS

Case No.	Initial User charge (Lv./m3)	Positive financial balance		FIRR	EIRR	Remarks
		Annual	Cumulative			
Case 4-1	400	From 6th year	From 9th year	6.35%	8.15%	Capital cost x 1.1
Case 4-2	400	From 10th year	From 14th year	5.40%	7.41%	O&M cost x 1.2

TABLE S.3.3 PROJECT EVALUATION FOR THE PRIORITY PROJECTS

Item	Pazardjik WWTP Project	Dimitrovgrad WWTP Project	Stara Zagora WWTP Project
1. Project Features			
1) Treatment for	Domestic wastewater	Domestic wastewater	Domestic wastewater
2) Design population (Year 2015)	97,000 person	61,000 person	165,000 person
3) Total daily average flow	29,400 m3/day	18,800 m3/day	49,400 m3/day
4) BOD load	5,240 kg/day	3,300 kg/day	8,890 kg/day
5) SS load	6,310 kg/day	3,980 kg/day	10,700 kg/day
6) Treatment process	Conventional activated sludge	Extended aeration process	Conventional activated sludge
7) Space for future treatment	TN and TP	TN and TP	TN and TP
2. Project Cost	US$ 25,662,000	US$ 15,370,000	US$ 29,760,000
3. Technical Evaluation			High technical viability
1) Reduction of domestic load (BOD)	Priority Town: 90 % Priority Region: 29 %	Priority Town: 90 % Priority Region: 32 %	Priority Town: 90 % Priority Region: 61 %
2) Water quality improvement (BOD)	Very high improvement effect in the Upstream Maritza. (Class III to Class I)	High improvement effect in the Downstream Maritza. (Middle level to higher level of Class I)	High improvement effect from Stara Zagora Town to middle stream of Sazliyka River. Very high improvement effect in the Downstream Maritza. (Beyond Class III to Class III)
3) Technical viability	Very high	Very High	Very high
4. Financial and Economic Evaluation			
1) Marginal condition			
- Initial user charge	Lv. 450/m3	Lv. 300/m3	Lv. 300/m3
- Positive financial balance	Annual from 12th year Cumulative from 19th year	Annual from 9th year Cumulative from 9th year	Annual from 12th year Cumulative from 19th year
- FIRR	3.35 %	3.87 %	2.99 %
- EIRR	5.19 %	5.26 %	4.91 %
2) Appropriate condition			
- Initial user charge	Lv. 550/m3	Lv. 400/m3	Lv. 400/m3
- Positive annual financial balance	Annual from 9th year Cumulative from 13th year	Annual from 3rd year Cumulative from 3rd year	Annual from 6th year Cumulative from 9th year
- FIRR	5.99 %	7.02 %	6.93 %
- EIRR	7.80 %	8.42 %	8.81 %
3) Evaluation	Acceptable to preferable range	Acceptable to preferable range	Acceptable to preferable range
5. Social Impact	1) Very high impact for improving living environment 2) Very high impact for realizing municipal responsibility to the people and river basin 3) Increasing employment opportunity	1) Very high impact for improving living environment 2) Very high impact for realizing municipal responsibility to the people and river basin 3) Increasing employment opportunity	1) Very high impact for improving living environment 2) Very high impact for realizing municipal responsibility to the people and river basin 3) Increasing employment opportunity
6. Environmental Impact	1) Very high impact for improving river water quality in the basin 2) No adverse impacts to natural environment	1) Very high impact for improving river water quality in the basin 2) No adverse impacts to natural environment	1) Very high impact for improving river water quality in the basin 2) No adverse impacts to natural environment
7. Summary of Project Viability	Very high viability	Very high viability	Very high viability

TABLE S.3.4 IMPLEMENTATION PROGRAM

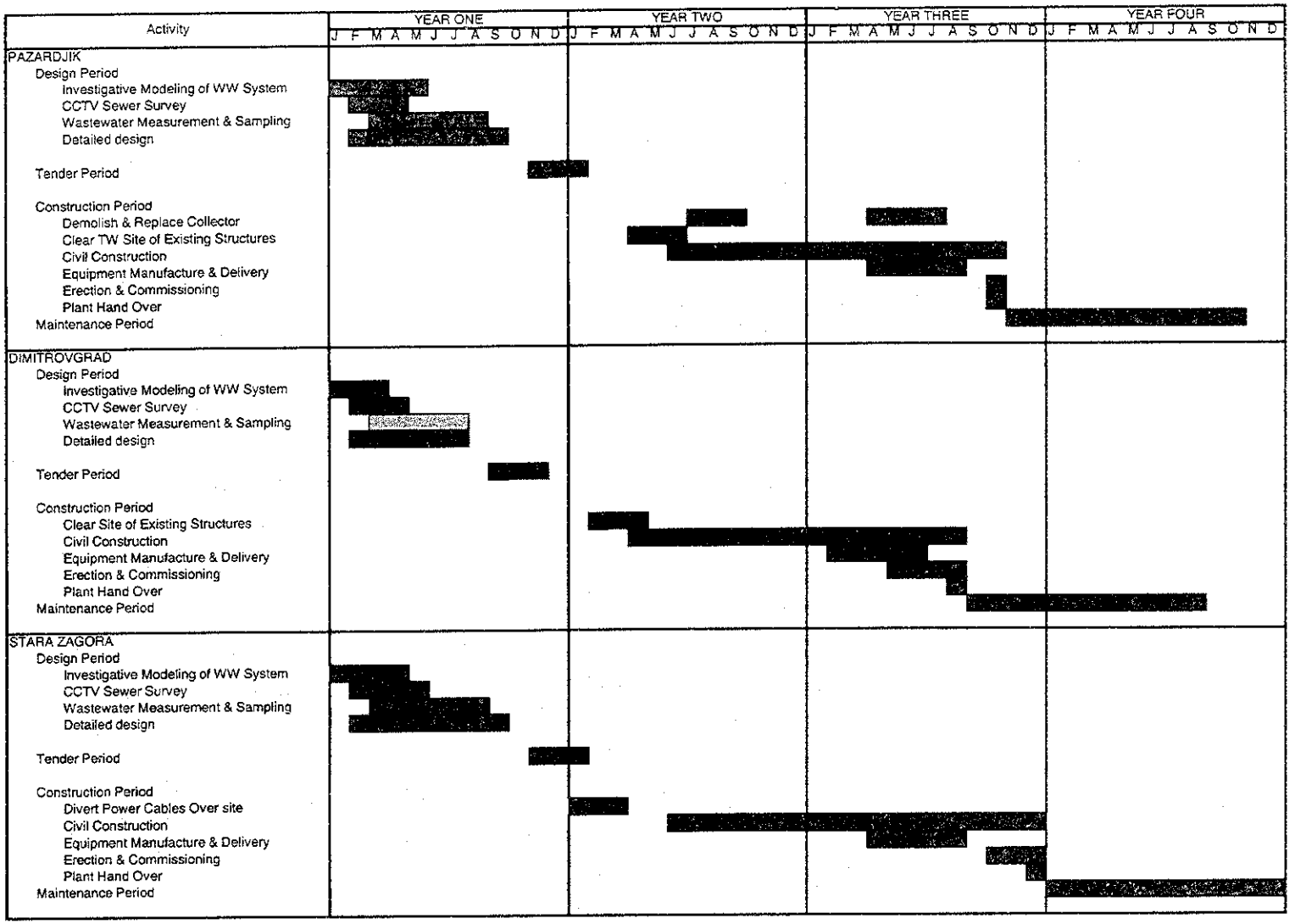


TABLE S.3.5 DISBURSEMENT SCHEDULE OF WWTPs (1/2)

1. Disbursement Schedule of Pazardjik WWTP Project

No.	Item	Unit		Cost			
				Year 2001	Year 2002	after Y 2003	Total
1.	Construction Cost						
1-1	Direct Cost	US$ 1000	Sub-total	9,870	9,870		19,740
		US$ 1000	FC	6,764	6,764		13,527
		US$ 1000	LC	3,107	3,107		6,213
1-2	Engineering	US$ 1000	Sub-total	987	987		1,974
		US$ 1000	FC	790	790		1,579
		US$ 1000	LC	197	197		395
1-3	Administration	US$ 1000	Sub-total	494	494		987
		US$ 1000	FC	0	0		0
		US$ 1000	LC	494	494		987
1-4	Physical Contingency	US$ 1000	Sub-total	1,481	1,481		2,961
		US$ 1000	FC	1,015	1,015		2,029
		US$ 1000	LC	466	466		932
1-5	Grand Total	US$ 1000	Total	12,831	12,831		25,662
		US$ 1000	FC	8,568	8,568		17,135
		US$ 1000	LC	4,263	4,263		8,527
2.	O&M	US$ 1000/year	Total	0	0	2,961	
	(15 % of 1-1)	US$ 1000/year	FC	0	0	0	
		US$ 1000/year	LC	0	0	2,961	

2. Disbursement Schedule of Dimitrovgrad WWTP Project

No.	Item	Unit		Cost			
				Year 2001	Year 2002	after Y 2003	Total
1.	Construction Cost						
1-1	Direct Cost	US$ 1000	Sub-total	5,912	5,912		11,823
		US$ 1000	FC	4,052	4,052		8,103
		US$ 1000	LC	1,860	1,860		3,720
1-2	Engineering	US$ 1000	Sub-total	591	591		1,182
		US$ 1000	FC	473	473		946
		US$ 1000	LC	118	118		236
1-3	Administration	US$ 1000	Sub-total	296	296		591
		US$ 1000	FC	0	0		0
		US$ 1000	LC	296	296		591
1-4	Physical Contingency	US$ 1000	Sub-total	887	887		1,773
		US$ 1000	FC	608	608		1,215
		US$ 1000	LC	279	279		558
1-5	Grand Total	US$ 1000	Total	7,685	7,685		15,370
		US$ 1000	FC	5,132	5,132		10,264
		US$ 1000	LC	2,553	2,553		5,106
2.	O&M	US$ 1000/year	Total	0	0	828	
	(7 % of 1-1)	US$ 1000/year	FC	0	0	0	
		US$ 1000/year	LC	0	0	828	

TABLE S.3.5 DISBURSEMENT SCHEDULE OF WWTPs (2/2)

3. Disbursement Schedule of Stara Zagora WWTP Project

No.	Item	Unit		Cost			
				Year 2001	Year 2002	after Y 2003	Total
1.	Construction Cost						
1-1	Direct Cost	US$ 1000	Sub-total	11,446	11,446		22,892
		US$ 1000	FC	8,095	8,095		16,189
		US$ 1000	LC	3,352	3,352		6,703
1-2	Engineering	US$ 1000	Sub-total	1,145	1,145		2,289
		US$ 1000	FC	916	916		1,831
		US$ 1000	LC	229	229		458
1-3	Administration	US$ 1000	Sub-total	572	572		1,145
		US$ 1000	FC	0	0		0
		US$ 1000	LC	572	572		1,145
1-4	Physical Contingency	US$ 1000	Sub-total	1,717	1,717		3,434
		US$ 1000	FC	1,214	1,214		2,428
		US$ 1000	LC	503	503		1,005
1-5	Grand Total	US$ 1000	Total	14,880	14,880		29,760
		US$ 1000	FC	10,224	10,224		20,449
		US$ 1000	LC	4,655	4,655		9,311
2.	O&M	US$ 1000/year	Total	0	0	3,434	
	(15 % of 1-1)	US$ 1000/year	FC	0	0	0	
		US$ 1000/year	LC	0	0	3,434	

Note:

1. Replacement of machine and electrical equipments shall be conducted in every 15 years after commencement of operation (Year 2017, Year 2032)
   Replacement cost is as follows:

1)	Pazardjik WWTP	FC	7,155	(US$ 1000/time)
		LC	795	(US$ 1000/time)
		Total	7,950	(US$ 1000/time)
2)	Dimitrovgrad WWTP	FC	5,262	(US$ 1000/time)
		LC	585	(US$ 1000/time)
		Total	5,847	(US$ 1000/time)
3)	Stara Zagora WWTP	FC	9,701	(US$ 1000/time)
		LC	1,078	(US$ 1000/time)
		Total	10,779	(US$ 1000/time)

FIGURES

FIG.S.1.1 STUDY AREA IN THE WHOLE MARITZA BASIN

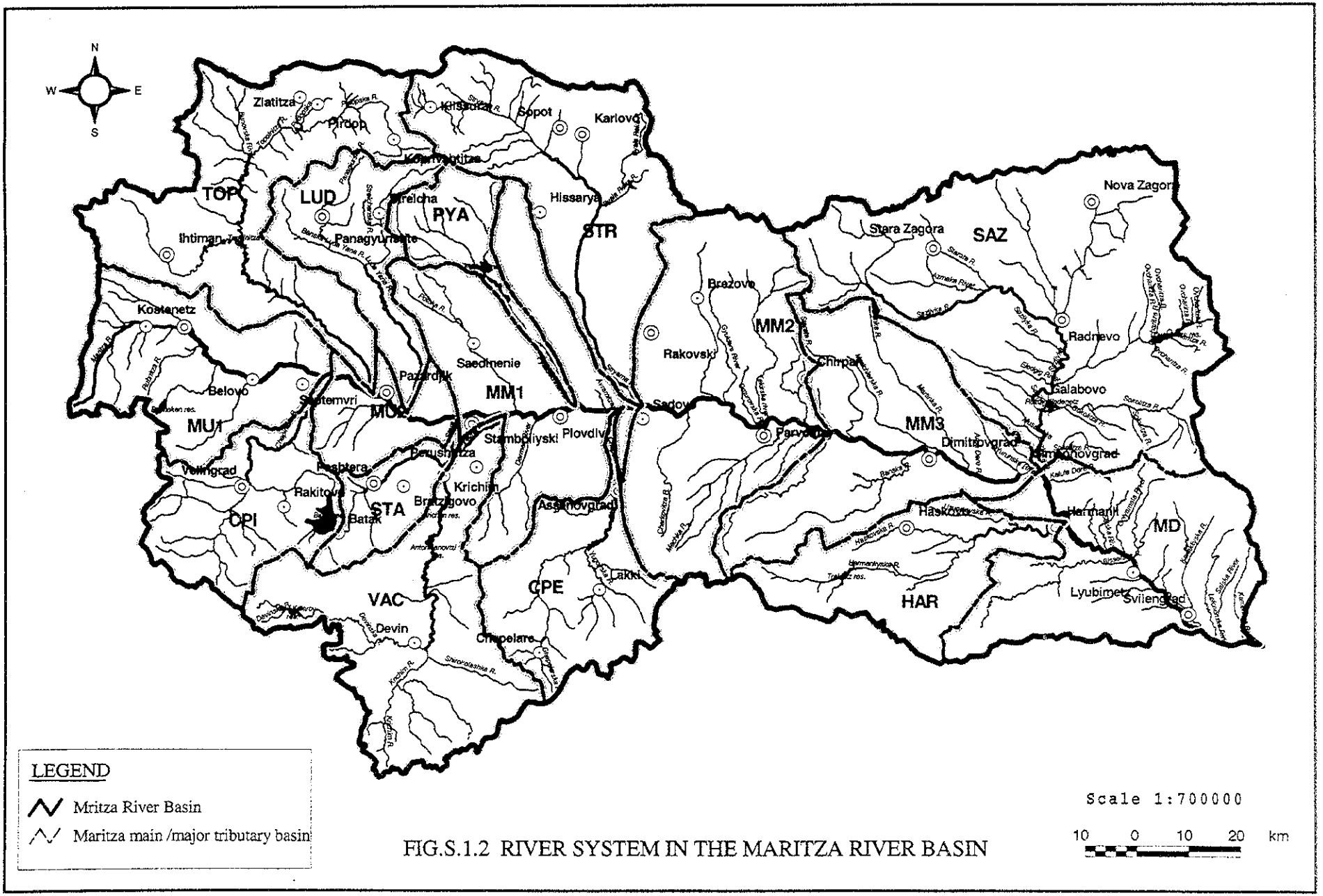
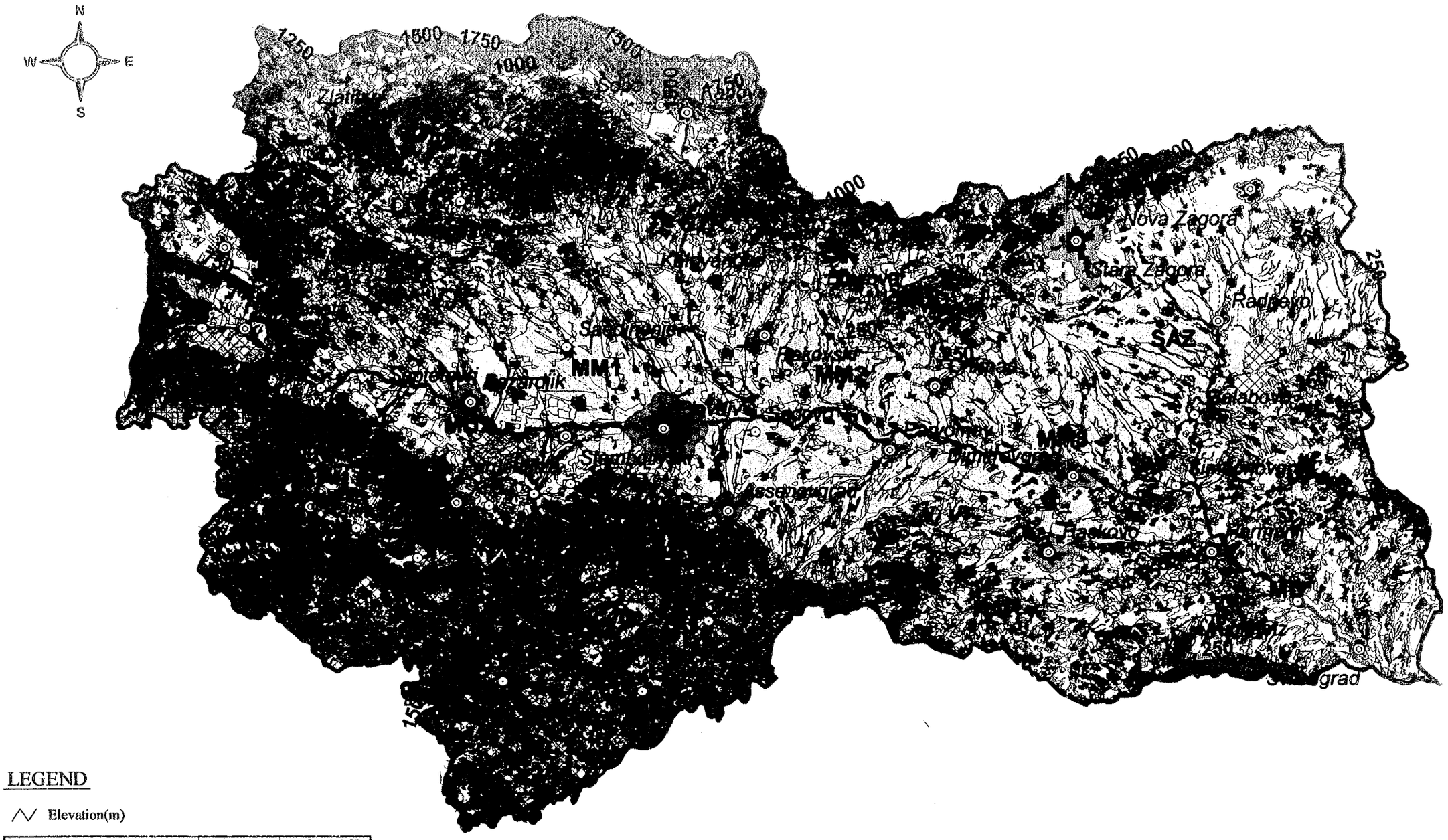


FIG.S.1.2 RIVER SYSTEM IN THE MARITZA RIVER BASIN



LEGEND

Elevation(m)

ZONING TYPE	AREA (km²)	PERCENTAGE (%)
Forest Area	6937	32.6
Agricultural Area	12825	60.3
Urban Area	1421	6.7
Conservation Area	3114	14.8
National Park	421	2.0

Scale 1:700000

10 0 10 20 km

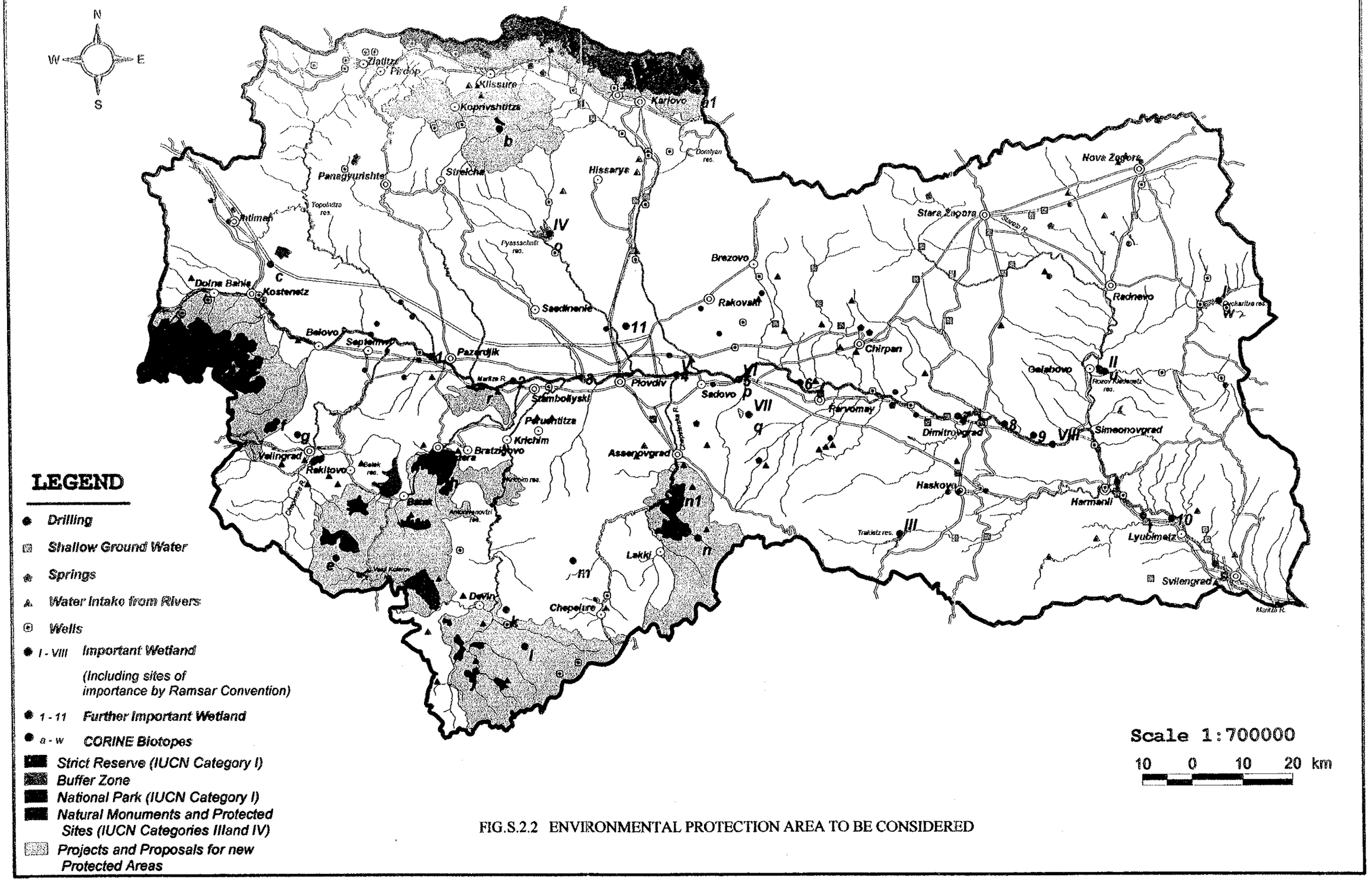
FIG.S.2.1 LANDUSE ZONING MAP

ZONING TYPE	AREA (km²)	PERCENTAGE (%)
Forest Area	6237	32.6
Agricultural Area	12825	66.3
Urban Area	1421	6.7
Conservation Area	3114	14.6
National Park	421	2.0

Scale 1:700000

10 0 10 20 km

FIG.S.2.1 LANDUSE ZONING MAP



LEGEND

- Drilling
- Shallow Ground Water
- Springs
- Water Intake from Rivers
- Wells
- I - VIII Important Wetland (Including sites of importance by Ramsar Convention)
- 1 - 11 Further Important Wetland
- a - w CORINE Biotopes
- Strict Reserve (IUCN Category I)
- Buffer Zone
- National Park (IUCN Category I)
- Natural Monuments and Protected Sites (IUCN Categories II and IV)
- Projects and Proposals for new Protected Areas

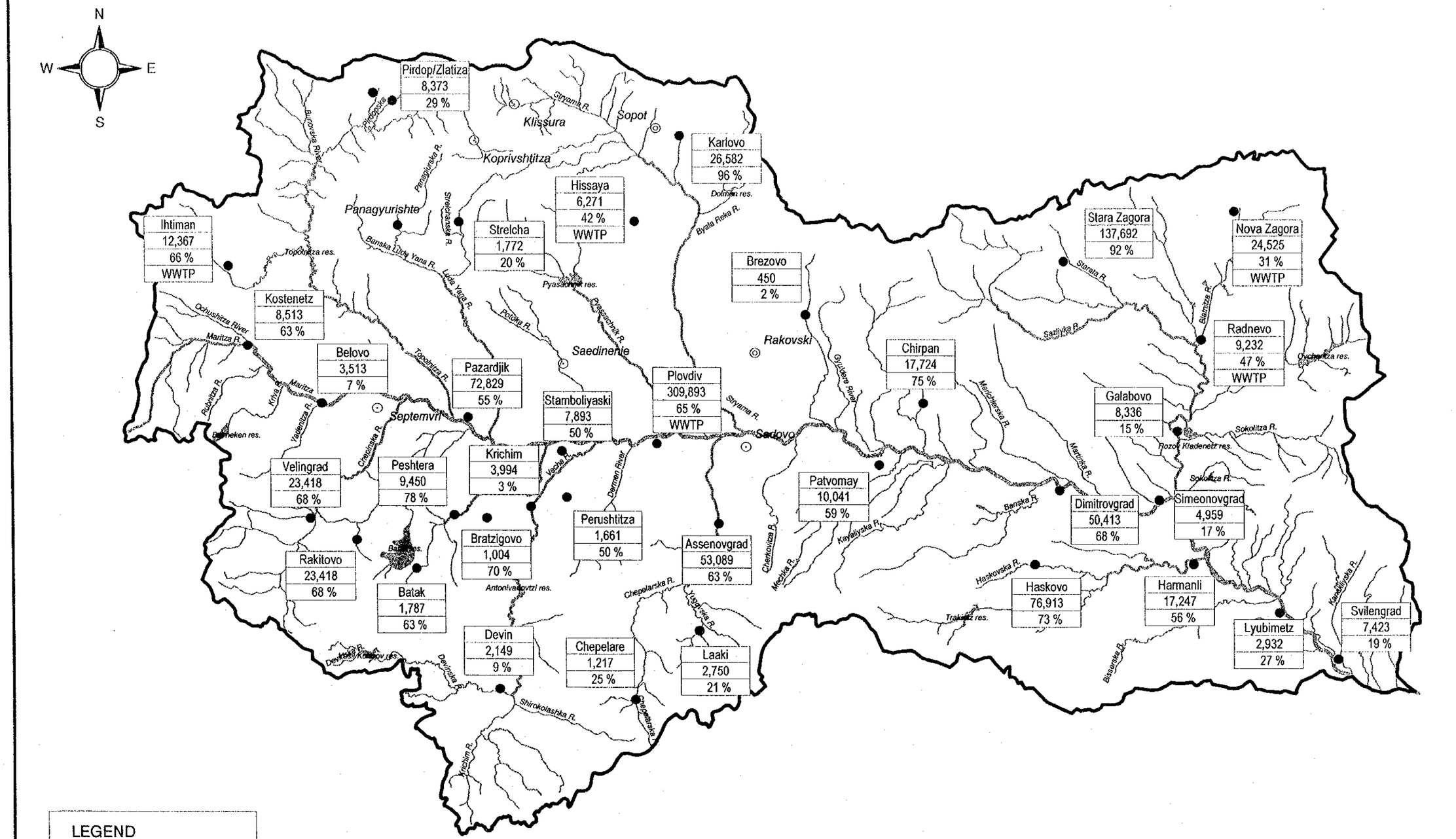
Scale 1:700000

10 0 10 20 km

FIG.S.2.2 ENVIRONMENTAL PROTECTION AREA TO BE CONSIDERED

National Parks (IUCN Category II)
Nature Monuments and Protected Sites (IUCN Categories III and IV)
Projects and Proposals for new Protected Areas

FIG.S.2.2 ENVIRONMENTAL PROTECTION AREA TO BE CONSIDERED



LEGEND

Plovdiv	Town
309,893	Population connected
65 %	Swewred by street %
WWTP	WWTP

SCALE 1 : 700000

10 0 10 20 km

FIG.S.2.3 TOWNS WITH SEWERAGE SYSTEMS

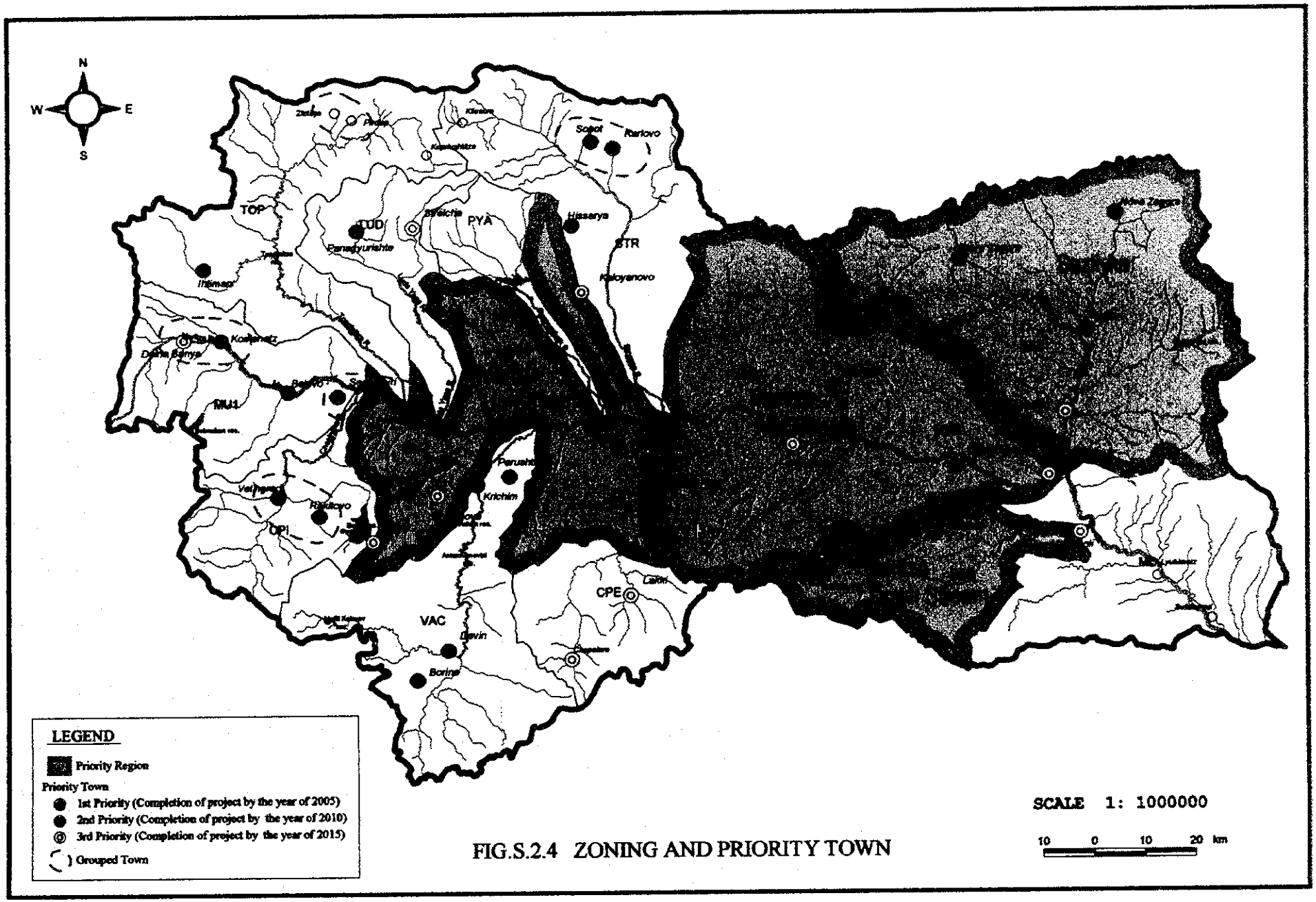


FIG.S.2.4 ZONING AND PRIORITY TOWN

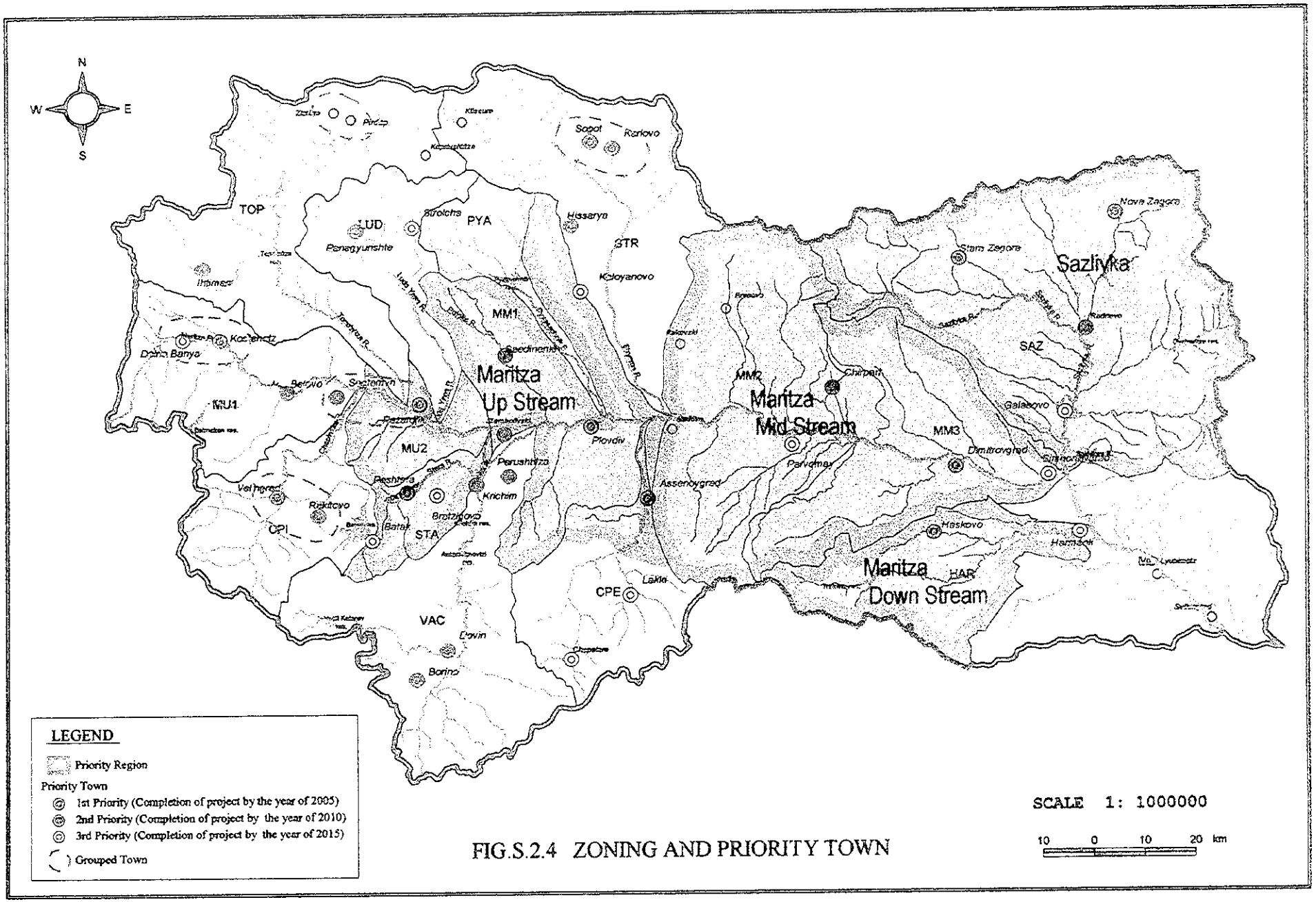


FIG.S.2.4 ZONING AND PRIORITY TOWN

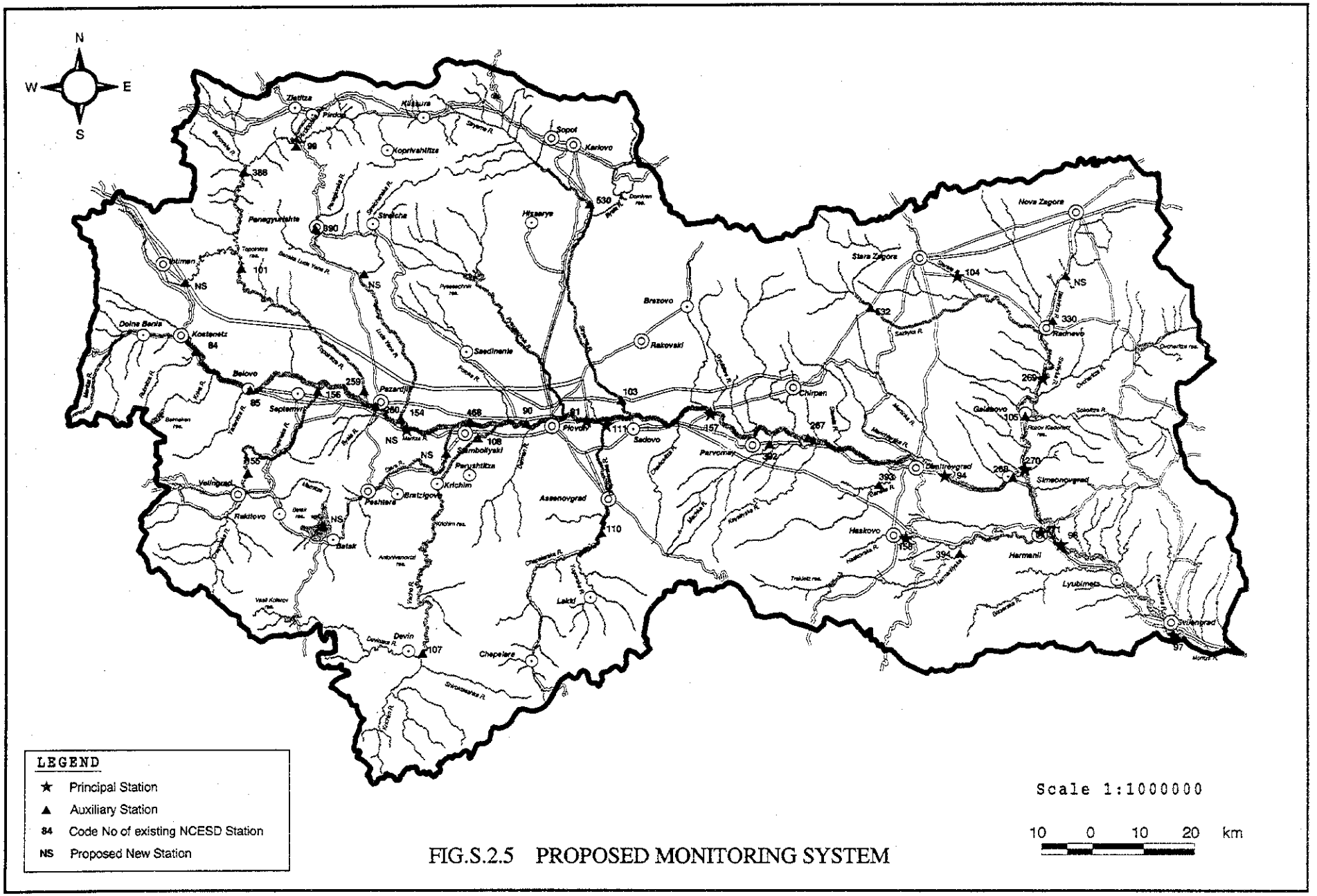


FIG.S.2.5 PROPOSED MONITORING SYSTEM

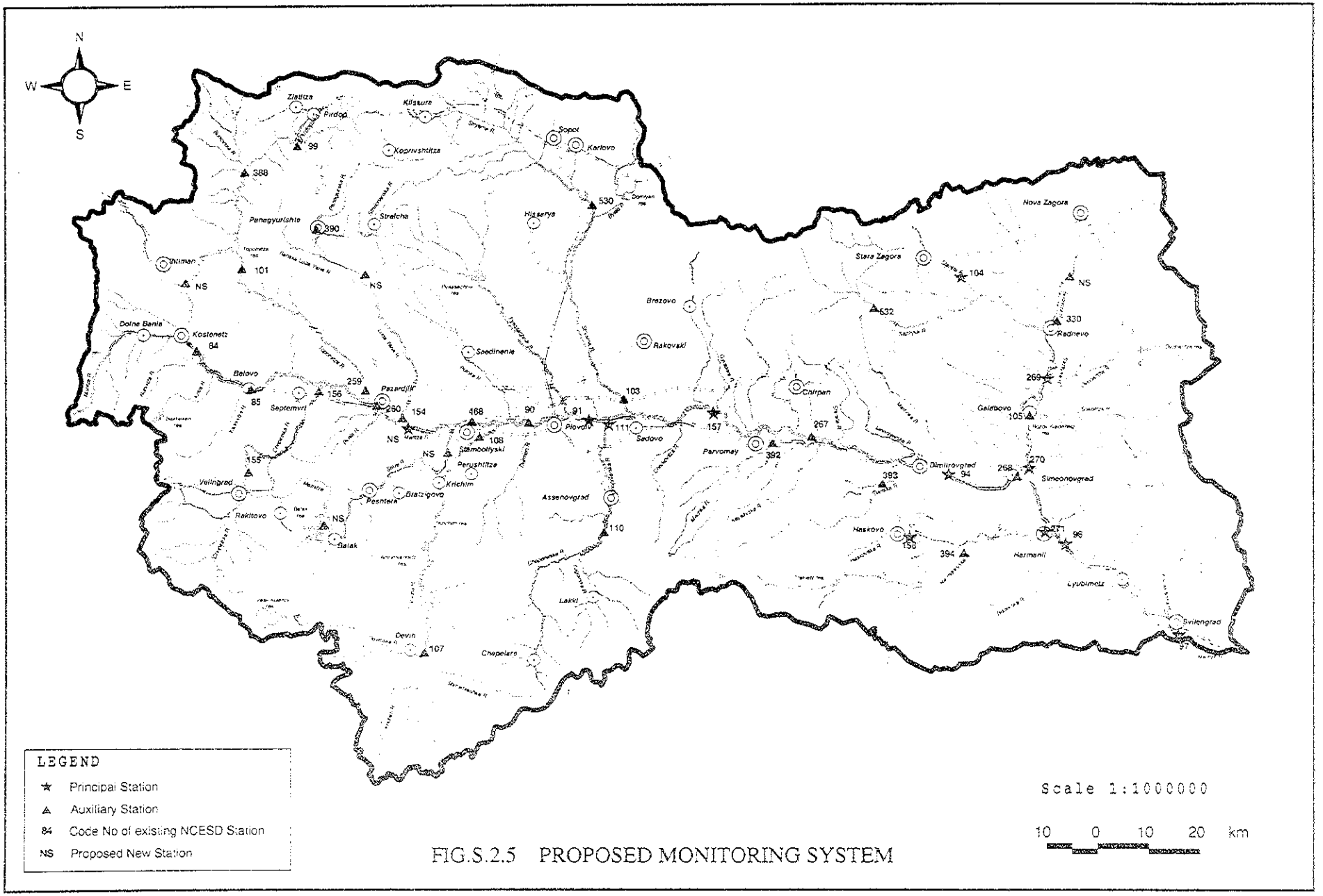


FIG.S.2.5 PROPOSED MONITORING SYSTEM

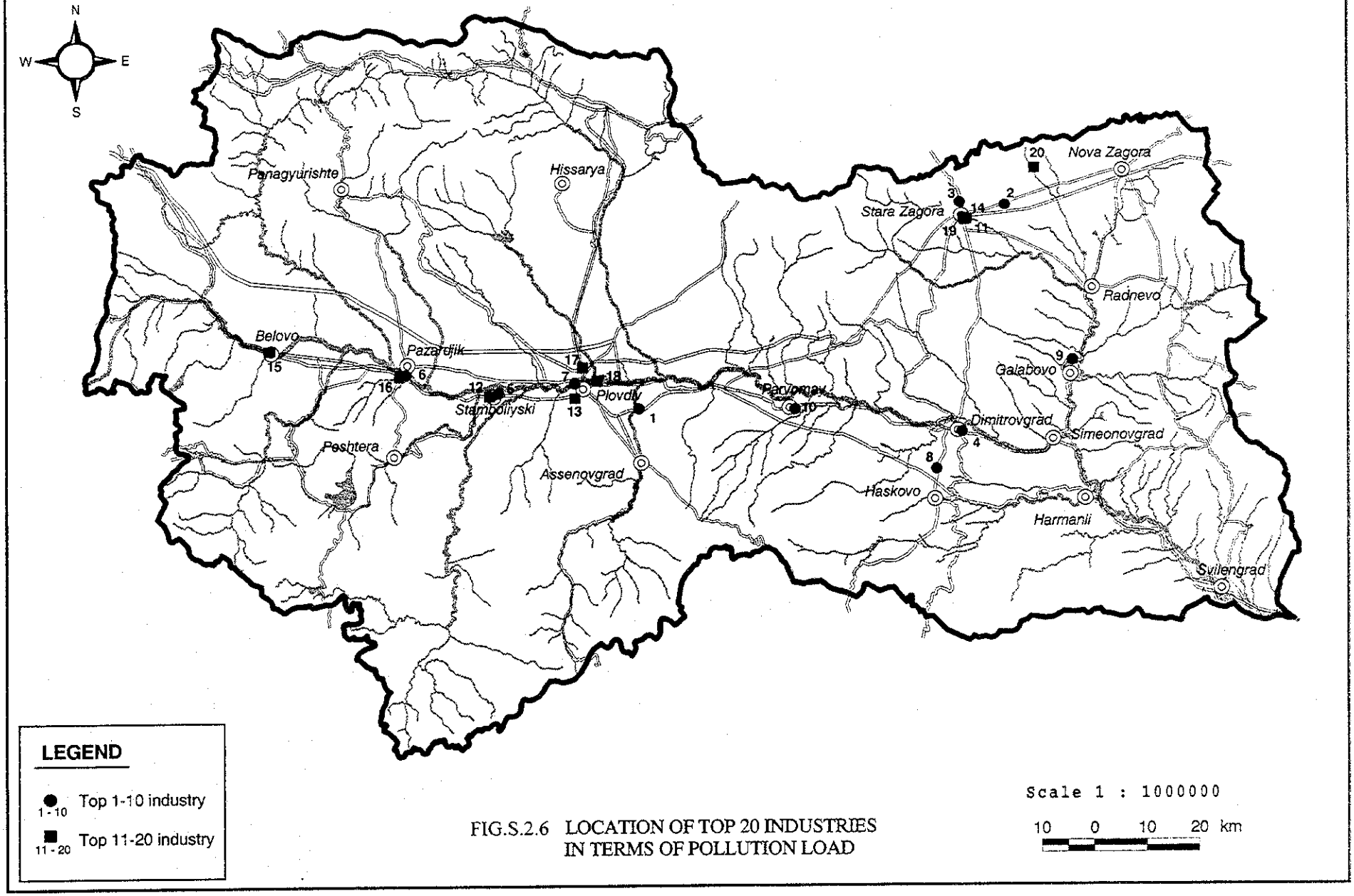


FIG.S.2.6 LOCATION OF TOP 20 INDUSTRIES IN TERMS OF POLLUTION LOAD