

6.7 Conclusion and Recommendation

Conclusions and recommendations relating to water resources in the Maritza River Basin are as follows;

- 1) Surface water in the Maritza River Basin is extensively used with very high utilization rates without so much consideration for the real water demand as well as balance between environment. Groundwater in the Maritza River Basin is also extensively used within a sustainable level, although there are rather big water supply loss. Therefore, it is recommendable to conduct efficient water use, so that not to use water excessively.
- 2) Forest area is a very important area of natural water resources. Therefore, it is recommendable to conserve the basins with wide forest area (Zone I) including reforestation.
- 2) Water resources potential in the basin are very much disturbed by numerous hydraulic facilities as well as inner-basin and inter-basin water transfer, but these facilities do not contribute for increasing annual and seasonal water resources potential effectively. Therefore, it is recommendable to update the operation of the existing hydraulic facilities to increase water resources potential effectively considering environment.
- 4) In relation to the control of water use as well as water resources potential, strengthening of monitoring systems for meteo-hydrology, water usage and artificial control of water is recommendable.
- 5) In relation to the water resources management plan for the Maritza River Basin, relating studies such as "Water Resources Management Study in Bulgaria",

“Agricultural Development Study in the Maritza River Basin”, “Water Balance of Hydropower Systems” and “Rehabilitation of Water Supply Systems” and “Post-Evaluation of the Existing Major Hydraulic Facilities” were proposed.

TABLE E.1.1 AREA AND ESTIMATED DIVISION OF IRRIGATION SYSTEMS BY IRRIGATION BRANCHES IN THE MARITZA RIVER BASIN

1 Area of Irrigation Systems

Irrigation System	Area announced by Irrigation Systems Ltd. (ha)	Measured Area on the Map (ha)	Percent (%)	Area incl. estimated value (ha)
	A1	A2	P=A1/A2	A1 or A1x P
Karabunar IS	9578	15167	63	9578
Varvara IS	7033	8118	87	7033
Topolnitsa IS	63413	75105	84	63413
Aleko Pazardjik IS	27410	37647	73	27410
Peshtera IS	3145	17015	18	3145
Velingrad IS	2255	8769	26	2255
Stryama Chirpan IS	13408	49194	27	13408
Domlyan IS	8805	13424	66	8805
Karlovo IS	2817	15353	18	2817
Krichim Cheshnigrovo IS	30986	25341	122	30986
Small ISs of Parvomay, Assenovgrad ISs		39775	27	10739
Stara Zagora IS	32198	44461	72	32198
Nova Zagora IS	12863	20388	63	12863
Small ISs in Saziyka Basin		6040	72	4374
Trakietz IS	21383	56894	38	21383
Biser IS	5494	20243	27	5494
Total	240787	452934	55	255900

Note: Percentage of italic values are the estimated referring to those of nearby irrigation system.

2 Estimated Irrigation Systems by Irrigation Branches

(Unit: ha)

Irrigation System	Irrigation Area	Irrigation Branch				
		Pazardjik IB	Plovdiv IB	Stara Zagora IB	Haskovo IB	Sliven IB
Karabunar IS	9578	9578				
Varvara IS	7033	7033				
Topolnitsa IS	63413	19024	44389			
Aleko Pazardjik IS	27410	19187	8223			
Peshtera IS	3145	2516	629			
Velingrad IS	2255	2255				
Stryama Chirpan IS	13408		13408			
Domlyan IS	8805		8805			
Karlovo IS	2817		2817			
Krichim Cheshnigrovo IS	30986		30986			
Small ISs of Parvomay, Assenovgrad ISs	10739		10739			
Stara Zagora IS	32198			32198		
Nova Zagora IS	12863					12863
Small ISs in Saziyka Basin	4374			4374		
Trakietz IS	21383				21383	
Biser IS	5494				5494	
Total	255900	59593	119996	36572	26877	12863
For Reference:						
Max. potential irrigation area in the water consumption data of Irrigation Systems Ltd.	268859	52000	123700	35196	45100	12863

Note: Area of italic values are estimated values in 1.

TABLE E.1.2 WATER SOURCES WITH RELATING INTAKES AND HYDROPOWER STATIONS OF THE IRRIGATION SYSTEMS

Irrigation System	Area of IS (ha)	Water Sources	Relating Intake/HPP
1. Karabunar IS	9758	1) Belmeken Res.	- Momina Klisura HPP
		2) Maritza River	- Momina Klisura Temporary Intake - Belovo Intakes
2. Varvara IS	7033	1) Batak Res.	- Aleko HPP
		2) Chepinska River	- Gated weir
3. Aleko Pazardjik IS	27410	1) Batak Res.	- Aleko HPP
		2) Maritza River	- Zlokutchene Intake - Pasha Arc Intake
		3) Topolnitza River	- Temporary river closing dike at Jct. Aleko Potoka Canal - Temporary river closing dike at Jct. Pasha Arc Canal
4. Peshtera IS	3145	1) Batak Res.	- Peshtera HPP
		2) Stara River	- Intake
5. Velingrad IS	2255	1) Chepinska River	- Gated weirs (2 nos.)
6. Topolnitza IS	63413	1) Topolnitza Res.	- Lissichevo Intake
		2) Belmeken Res.	- Momina Klisura HPP
		3) Pyassachnik Res.	- Pyasschnik Dam
		4) Maritza River	- Momina Klisura Temporary Intake - Closing dike at Jct. Eni Arc Canal
		5) Topolnitza River	- Lissichevo Intake - Gelemena Intake
7. Stryama Chirpan IS	13408	1) Pyassachnik Res.	- Pyassachnik Dam
		2) Stryama River	- Temporary Intake
8. Domlyan IS	8805	1) Domlyan Res.	- Domlyan Dam
9. Karlovo IS	2817	1) Stryama River	- Intakes (2 nos.)
10. Krichim Cheshnigirovo IS	30986	1) Krichim Res.	- Krichim HPP
		2) Krichim River	- Krichim Intake
11. Small ISs of Parvomay, Assenovgrad ISs	10739	1) Chepelarska River	- Headworks (2 nos)
12. Stara Zagora IS	32198	1) Koprinka Res.	- Water transfer facility - Stara Zagora HPP
13. Nova Zagora IS	12863	1) Jrebchevo Res.	- Water transfer facility
14. Small ISs in Sazliyka Basin	4374		
15. Trakietsz IS	21383	1) Trakietsz Res.	- Trakietsz Dam - Temporary river closing dike in the Maritza River (upstream Dimitrograd)
16. Biser IS	5494	1) Maritza River	
Total Area	255900		

TABLE E.1.3 BELMEKEN-SESTRIMO-CHAIRA HYDROPOWER SCHEME

1) DAMS

No.	Name of Dam	Construct. year	Type	Height (m)	Length (m)	Volume (10 ³ m ³)	Created reservoir
1-1	Belmeken Dam	1975	Rockfill	98.0	737.5	3,325	Belmeken Res.
1-2	Belmeken Tail Dam	1975	Earth-rockfill	29.3	537.0	466	- do -
1-3	Stankovi Baraki Dam	1974	Rockfill	39.0	100.0	153	Stankovi Baraki Res.
1-4	Chaira Dam	1990	Concrete Gravity	85.0	305.0		Chaira Res.

2) RESERVOIRS

No.	Name of Reservoir	Purpose	Gross storage (10 ⁶ m ³)	Active storage (10 ⁶ m ³)	Dead storage (10 ⁶ m ³)	Function
2-1	Belmeken Reservoir	Multi-purpose Main: HP Sub: IR, WS	144.04	138.49	5.55	- Main reservoir of the whole scheme - Upper reservoir of Chaira PSP
2-2	Stankovi Baraki Reservoir	Hydropower	0.42	0.38	0.04	- Lower reservoir at Belmeken HPP-PSPP
2-3	Chaira Reservoir	Hydropower	5.54	4.17	1.37	- Lower reservoir of Chaira PSPP

Note: HP: hydropower, IR: Irrigation, WS: water supply

3) HYDROPOWER PLANTS

No.	Name of Hydropower Plant	Design discharge (m ³ /s)	Installed capacity (MW)	Design energy output (GWh)	Inflow from	Outflow to
3-1	Belmeken HPP/PSPP	62.5/13.5	375/104	556	Belmeken Res.	Stankovi Baraki Res.
3-2	Sestrimo HPP	60.0	240	421	Stankovi Baraki Res.	Momina Kusura HPP
3-3	Momina Klisura HPP	56.6	120	198	Sestrimo HPP	Momina Klisura-Lissichevo Irr. Canal Pyassachnik Res.
2-3	Chaira PSPP	144.4/118.0	864/788	1180	Belmeken Res.	Chaira Res.

Notes: Values of xxx/yyy: xxx is the total design value and yyy is the design value for pumped storage.

4) WATER TRANSFER (MAJOR FEEDER CANALS)

No.	Name of feeder canals	Max. discharge (m ³ /s)	No. of intakes	Collecting water from	Flow into
4-1	Granchar F.C.	21.9	104	Struma R., Mesta R.	Belmeken Res., Beli Iskar Res.
4-2	Maritza 1900 F.C.	10.4	15	Maritza R.	Belmeken Res.
4-3	Jaferitza F.C.	0.7	15	Mesta R.	Belmeken Res.
4-4	Maritza 1200 F.C.	9.9	27	Maritza R.	Stankovi B. Res.
4-5	Iadenitza F.C.	2.0	17		Chaira F.C.
4-6	Chaira F.C.	3.1	8		Stankovi B. Res.

Data source: Natsionalna Elektricheska Kompania AD and ENERGOPROEKT-PLC

TABLE E.1.4 BATAK CASCADE SCHEME

1) DAMS

No.	Name of Dam (temporary for the study)	Construct. year	Type	Height (m)	Length (m)	Volume (10 ³ m ³)	Created reservoir
1-1	Shiroka Poliana Concrete Dam	1962	Concrete Gravity	21.0			Shiroka Poliana Res.
1-2	Shiroka Poliana Earth Dam	1962	Earthfill	16.0			Shiroka Poliana R.
1-3	Vasil Kolarov Dam	1951	Stone masonry	46.5	191.0		Vasil Kolarov Res.
1-4	Beglika Dam	1958	C. Gravity	18.3	73.5		Beglika Res.
1-5	Toshkov Chark Dam	1958	Stone masonry	18.5	97.0		Toshkov Chark Res.
1-6	Batak Dam	1958	Earthfill	35.0	273.0		Batak Res.

2) RESERVOIRS

No.	Name of Reservoir	Purpose	Gross storage (10 ⁶ m ³)	Active storage (10 ⁶ m ³)	Dead storage (10 ⁶ m ³)	Function
2-1	Vasil Kolarov Reservoir	Hydropower	62.11	58.17	3.94	
2-2	Beglika Reservoir	Hydropower	1.56	1.31	0.25	
2-3	Toshkov Chark Reservoir	Hydropower	1.77	1.52	0.25	
2-4	Shiroka Poliana Reservoir	Hydropower	24.00	20.70	3.30	- Upper storage of the scheme
2-5	Batak Reservoir	Multi-purpose Main: HP Sub: IR	310.30	290.00	20.30	- Main reservoir of the scheme

Note: HP: hydropower, IR: Irrigation, WS: water supply

3) HYDROPOWER PLANTS

No.	Name of Hydropower Plant	Design discharge (m ³ /s)	Installed capacity (MW)	Design energy output (GWh)	Inflow from	Outflow to
3-1	Batak HPP	13.6	40	167.7	Vasil Kolarov Res.	Batak Res.
3-2	Peshtera HPP	26.0	128	440.7	Batak Res.	Aleko HPP
3-3	Aleko HPP	30.0	64.8	202.1	Peshtera HPP	Aleko Potoka Irr. Canal

Note: IRR: irrigation system

4) WATER TRANSFER (MAJOR FEEDER CANALS)

No.	Name of feeder canals	Max. discharge (m ³ /s)	No. of intakes	Collecting water from	Inflow into
4-1	Bistritsa F.C.	15.0	18	Matritza River	Batak Res.
4-2	Nova Mahala F.C.	1.8	28	Stara River	Batak Res.
4-3	Ravnogor F.C.	4.3	15	Stara River	Batak Res.

Data source: Natsionalna Elektricheska Kompania AD and ENERGOPROEKT-PLC

TABLE E.1.5 DOSPAT - VACHA CASCADE SCHEME

1) DAMS

No.	Name of Dam	Construct. year	Type	Height (m)	Length (m)	Volume (10 ³ m ³)	Created reservoir
1-1	Dospat Dam	1967	Rockfill	60.5	230.0		Dospat Res.
1-2	Antonivanovtzi Dam	1974	Concrete Gravity	144.0	420.0		Antonivanovtzi Res.
1-3	Krichim Dam	1972	Concrete Gravity	104.5	259.0		Krichim Res.

2) RESERVOIRS

No.	Name of Reservoir	Purpose	Gross storage (10 ⁶ m ³)	Active storage (10 ⁶ m ³)	Dead storage (10 ⁶ m ³)	Function
2-1	Dospat Reservoir	Multi-purpose Main: HP Sub: IR, WS	446.38	431.47	14.91	- Upper reservoir the scheme - Storage of water of the Mesta River
2-2	Antonivanovtzi Reservoir	Hydropower	226.10	122.10		- Major res. in the scheme - Res. for Krichim Cheshnigirovo IS - Water supply of Plovdiv area
2-4	Krichim Reservoir	Hydropower	20.30	12.4		- Compensating basin for Krichim HPP and Vacha I & II HPPs - Lower basin of Antonivanovtzi PSPP

Note: HP: hydropower, IR: Irrigation, WS: water supply

3) HYDROPOWER PLANTS

No.	Name of Hydropower Plant	Design discharge (m ³ /s)	Installed capacity (MW)	Design energy output (GWh)	Inflow from	Outflow to
3-1	Teshel HPP	26.0	60.0	166.2	Dospat Res.	Teshel Res.
3-2	Devin HPP	72.8	80.0	122.0	Teshel Res.	Vacha River
3-3	Antonivanovtzi HPP/PSPP	111.8/115.0	163.6/40.0	245.0	Antonivanovtzi Res.	Krichim Res.
3-4	Krichim HPP	61.0	80.0	197.4	Krichim Res.	Krichim Cheshnigirovo IS via Krichim Weir
3-5	Vacha I HPP	20.0	14.0	21.6	Vacha II HPP	Krichim Cheshnigirovo IS
3-4	Vacha II HPP	9.2	7.0	21.4	Krichim Res.	Vacha I HPP

Notes: Values of xxx/yyy: xxx is the total design value and yyy is the design value for pumped storage.

4) WATER TRANSFER (MAJOR FEEDER CANALS)

No.	Name of feeder canals	Max. discharge (m ³ /s)	No. of intakes	Collecting water from	Flow into
4-1	Pressure tunnel Dospat Res. to Teshel Res.		3	Water of Mesta River Basin	Vacha River Basin

Data source: Natsionalna Elektricheska Kompania AD and ENERGOPROEKT-PLC

TABLE E.2.1 MAJOR RESERVOIRS IN THE STUDY AREA WITH RELATING RESERVOIRS

Reservoir	River	Purpose	Reservoir Volume (mil. m3)	Dam Height (m)
Topolnitza	Topolitza River	Irrigation, hydropower	141.35	78.0
Trakietz	Harmanliyska River	Irrigation	114.00	44.0
Pyassachnik	Pyassachnik River	Irrigation	211.40	42.0
Ovcharitza	Ovcharitza River	Cooling water of thermal P.P	45.80	22.0
Belmeken	Kriva River	Hydropower, irrigation, water supply	144.04	98.0
Batak	Matnitza River (Chepinska R. Basin)	Hydropower, irrigation	310.30	35.0
Antonivanovtzi	Vacha River	Hydropower, irrigation	226.10	144.0
Krichim	Vacha River	Hydropower	20.30	104.5
Relating reservoir (other basin)				
Koprinka	Tundza River	Irrigation, water supply	142.20	44.0
Jrebchevo	Tundza River	Irrigation, water supply	400.00	53.0
Dospat Reservoir	Nestos River (Mesta R. Basin)	Hydropower, irrigation, water supply	446.38	60.5
Vasil Kolarov Reservoir	Upstream of Vacha River Basin	Hydropower	62.11	46.5
Shiroka Poliana Reservoir	Left tributary of Nestos River (Mesta R. Basin)	Hydropower	24.00	16.0
Beli Iskar Reservoir	Iskar River Basin	Water supply	400.00	53.0

Data source: Irrigation Systems Ltd.

TABLE E.3.1 AREA AND PATTERN OF CROPS OF IRRIGATION SYSTEMS

1 Estimated Crop Areas by Irrigation Systems in 1996

Irrigation System	Command area (ha)	Actual irrigated area (ha)	Percent of irrigation (%)	Maize (ha)	Tobacco (ha)	Sugar beet (ha)	Lucerne (ha)	Vegetable (ha)	Fruit trees (ha)	Rice (ha)	Other (ha)
1) Pazardjik Irrigation Branch	49421	5013	10.1	1675	582	0	30	371	620	711	1024
Karabunar IS	9578	972	10.1	318	111	0	6	70	118	155	194
Varvara IS	7033	713	10.1	234	81	0	4	52	86	114	143
Aleko Pazardjik IS	27410	2780	10.1	910	316	0	16	202	337	443	556
Peshtera IS	3145	319	10.1	124	43	0	2	28	46	0	76
Velingrad IS	2255	229	10.1	89	31	0	2	20	33	0	54
2) Plovdiv Irrigation Branch	130169	20147	15.5	5891	1622	20	342	2039	1148	2353	6732
Topolnitsa IS	63413	9815	15.5	2606	718	9	151	902	508	1942	2978
Stryama Chirpan IS	13408	2075	15.5	551	152	2	32	191	107	411	630
Domlyan IS	8805	1363	15.5	451	124	2	26	156	88	0	516
Karlovo IS	2817	436	15.5	144	40	0	8	50	28	0	165
Krichim Cheslunigrovo IS	30986	4796	15.5	1588	437	5	92	550	309	0	1814
Small ISs of Parvomay, Assenovgrad ISs	10739	1662	15.5	550	152	2	32	190	107	0	629
3) Stara Zagora Irrigation Branch	36572	7820	21.4	3560	582	120	502	323	686	165	1892
Stara Zagora IS	32198	6885	21.4	3125	511	105	441	284	602	165	1652
Small ISs in Sazlyka Basin	4374	935	21.4	435	71	15	61	39	84	0	230
4) Shiven Irrigation Branch	12863	2750	21.4	1279	209	43	180	116	246	0	676
Nova Zagora IS	12863	2750	21.4	1279	209	43	180	116	246	0	676
5) Haskovo Irrigation Branch	26877	6253	23.3	2285	1235	0	90	1207	25	0	1411
Trakietz IS	21383	4975	23.3	1818	983	0	72	960	20	0	1123
Biser IS	5494	1278	23.3	467	252	0	18	247	5	0	288
Whole Systems	255900	41983	16.4	14690	4230	183	1144	4956	2725	3229	11725

- Note:
- 1) Irrigation System (IS), Irrigation Branch (IB)
 - 2) (Utilized area of IS)=(Command area of IS) x (Percentage of irrigation of IB)
 - 3) Crop areas of IS with rice cultivation:
(Rice area of IS)=(Rice area of IB) x (Max. area of IS)/(Max. area of IB)-(Area of IS without rice)
(Area of other crops)=((Total crop area) - (Rice area)) x (crop percentage without rice)
 - 4) Crop areas of IS without rice cultivation:
(Area of other crops)=(Total crop area) x (crop percentage without rice)
 - 5) Crop areas of Topolnitsa IS is estimated based on the crop pattern of Plovdiv IB.
 - 6) Crop areas of Aleko Pazardjik IS is estimated based on the crop pattern of Pazardjik IB.

2 Estimated Percentage Crop Areas by Irrigation Systems in 1996

Irrigation System	(Unit: %)									
	Maize	Tobacco	Sugar beet	Lucerne	Vegetable	Fruit trees	Rice	Other	Total	
1) Pazardjik Irrigation Branch	33	12	0	1	7	12	14	20	100	
Karabunar IS	33	11	0	1	7	12	16	20	100	
Varvara IS	33	11	0	1	7	12	16	20	100	
Aleko Pazardjik IS	33	11	0	1	7	12	16	20	100	
Peshtera IS	39	14	0	1	9	14	0	24	100	
Velingrad IS	39	14	0	1	9	14	0	24	100	
2) Plovdiv Irrigation Branch	29	8	0	2	10	6	12	33	100	
Topolnitsa IS	27	7	0	2	9	5	20	30	100	
Stryama Chirpan IS	27	7	0	2	9	5	20	30	100	
Domlyan IS	33	9	0	2	11	6	0	38	100	
Karlovo IS	33	9	0	2	11	6	0	38	100	
Krichim Cheslunigrovo IS	33	9	0	2	11	6	0	38	100	
Small ISs of Parvomay, Assenovgrad ISs	33	9	0	2	11	6	0	38	100	
3) Stara Zagora Irrigation Branch	46	7	2	6	4	9	2	24	100	
Stara Zagora IS	45	7	2	6	4	9	2	24	100	
Small ISs in Sazlyka Basin	47	8	2	7	4	9	0	25	100	
4) Shiven Irrigation Branch	47	8	2	7	4	9	0	25	100	
Nova Zagora IS	47	8	2	7	4	9	0	25	100	
5) Haskovo Irrigation Branch	37	20	0	1	19	0	0	23	100	
Trakietz IS	37	20	0	1	19	0	0	23	100	
Biser IS	37	20	0	1	19	0	0	23	100	
Whole Systems	35	10	0	3	10	6	8	28	100	

TABLE E.3.2

ESTIMATED MONTHLY WATER DEMAND OF STATE IRRIGATION SYSTEMS

1 Year 1994

Irrigation System	Actual supplied irrigation water												Before 1989 by EWI				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		Annual			
1. Plovdiv Irrigation Branch	0	0	0	103	622	12389	18085	17877	7333	0	0	0	62316	1993	1994	1995	1996
Karanovo IS	0	0	0	12	724	2187	2253	741	0	0	0	0	7457	702939	394844	392678	386016
Varna IS	0	0	0	8	548	1158	1564	1675	490	0	0	0	5462	0	0	0	33910
Alsko Pazariq IS (70%)	0	0	0	27	1923	3622	5499	5153	2117	0	0	0	18342	0	0	0	38310
Topolnitsa IS (30%)	0	0	0	23	3157	5753	8264	8023	3428	0	0	0	28619	0	0	0	151636
Pezera IS (80%)	0	0	0	6	25	157	573	480	318	0	0	0	1439	0	0	0	126621
Vidin IS	0	0	0	3	33	138	283	283	118	0	0	0	857	0	0	0	8660
2. Plovdiv Irrigation Branch	0	0	0	260	11331	25016	34550	42256	29010	0	0	0	136423	2890148	1484093	9164817	1184249
Topolnitsa IS (70%)	0	0	0	59	7565	19333	19382	18730	7998	0	0	0	65777	0	0	0	390239
Alsko Pazariq IS (30%)	0	0	0	20	824	1544	2357	2208	907	0	0	0	7861	0	0	0	63944
Pezera IS (80%)	0	0	0	2	14	49	93	122	80	0	0	0	360	0	0	0	2352
Stoyana Charan IS	0	0	0	74	2181	3736	5604	5543	2396	0	0	0	19355	0	0	0	0
Dombava IS	0	0	0	0	152	699	1239	2323	1960	0	0	0	6503	0	0	0	0
Karlovo IS	0	0	0	0	44	306	373	863	637	0	0	0	2223	0	0	0	0
Krichim Chashigrovo IS	0	0	0	34	552	2663	5737	8872	6726	0	0	0	24545	0	0	0	110390
Small IS of Plovdiv, Aasenovgrad IS	0	0	0	30	199	815	1846	3404	2306	0	0	0	8620	0	0	0	0
3. Stara Zagora Irrigation Branch with	0	0	0	61	2083	7932	13446	24413	16984	0	0	0	64141	253725	173897	192882	492002
Stara Zagora IS	0	0	0	48	1601	6077	9590	16294	10431	0	0	0	44002	0	0	0	0
Narta Zepora	0	0	0	0	0	319	1475	2855	6044	4120	0	0	14822	0	0	0	0
Narta Zepora	0	0	0	13	123	382	1203	2074	1435	0	0	0	5227	0	0	0	0
Small IS in Srednya Basin	0	0	0	3	618	3111	8893	12348	2178	0	0	0	30017	194701	46356	342469	61994
4. Haskovo Irrigation Branch	0	0	0	3	479	2501	7113	9736	3728	0	0	0	24580	0	0	0	0
Trilazir	0	0	0	0	156	811	1689	2572	1420	0	0	0	6637	0	0	0	0
Biser	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Whole System	0	0	0	428	20556	46448	77084	94853	53328	0	0	0	294898	3841413	2099277	1536417	2124257

2 Year 1995

Irrigation System	Actual supplied irrigation water												Before 1989 by EWI				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		Annual			
1. Plovdiv Irrigation Branch	0	0	0	357	6329	10975	15954	15340	6482	703	0	0	55740	192159	394844	392678	386016
Karanovo IS	0	0	0	36	2277	1809	1864	771	75	0	0	0	6688	0	0	0	3910
Varna IS	0	0	0	40	532	1048	1381	1369	569	55	0	0	4993	0	0	0	38310
Alsko Pazariq IS (70%)	0	0	0	138	1847	3192	4717	4470	1812	162	0	0	16338	0	0	0	135636
Topolnitsa IS (30%)	0	0	0	91	3142	4816	7515	6948	2869	365	0	0	25745	0	0	0	128561
Pezera IS (80%)	0	0	0	21	47	153	276	404	276	25	0	0	1201	0	0	0	9408
Vidin IS	0	0	0	11	25	89	156	285	186	22	0	0	774	0	0	0	8660
2. Plovdiv Irrigation Branch	0	0	0	623	11333	18494	32806	36319	18170	2436	0	0	121164	2680048	1484093	9164817	1184249
Topolnitsa IS (70%)	0	0	0	213	7331	12336	17534	16213	6653	851	0	0	60072	0	0	0	300209
Alsko Pazariq IS (30%)	0	0	0	59	702	1368	2022	1916	777	70	0	0	7002	0	0	0	45944
Pezera IS (80%)	0	0	0	3	32	38	69	101	69	4	0	0	396	0	0	0	2352
Stoyana Charan IS	0	0	0	54	2173	3089	5300	5013	2007	262	0	0	17899	0	0	0	0
Dombava IS	0	0	0	45	127	135	1291	2093	1641	218	0	0	5318	0	0	0	0
Karlovo IS	0	0	0	19	43	387	578	318	518	70	0	0	1680	0	0	0	0
Krichim Chashigrovo IS	0	0	0	173	667	1817	4728	7626	5434	699	0	0	21084	0	0	0	110390
Small IS of Plovdiv, Aasenovgrad IS	0	0	0	56	245	749	1526	2770	2029	253	0	0	7628	0	0	0	0
3. Stara Zagora Irrigation Branch with	0	0	0	457	2027	6593	13521	20952	9790	1017	0	0	54337	253725	173897	192882	492002
Stara Zagora IS	0	0	0	304	1601	4363	8880	14224	6333	667	0	0	36375	0	0	0	0
Narta Zepora	0	0	0	150	302	1394	3525	5073	2459	266	0	0	13381	0	0	0	0
Small IS in Srednya Basin	0	0	0	23	124	644	1116	1633	956	84	0	0	4381	0	0	0	0
4. Haskovo Irrigation Branch	0	0	0	6	590	4940	8654	5561	4872	593	0	0	28316	194701	46356	342469	61994
Trilazir	0	0	0	0	6	451	6633	2427	3709	405	0	0	22917	0	0	0	0
Biser	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Whole System	0	0	0	1462	29288	49692	79937	92143	49314	4651	0	0	240357	3841413	2099277	1536417	2124257

Note: 1) Monthly and annual irrigation water demand were estimated by JICA Study based on actual cropping pattern and FAO standard for irrigation water requirement.
 2) Actual irrigation water of the Irrigation Branch was based on the data of the Irrigation Systems Ltd.
 3) Estimated irrigation demand includes 50% water loss.
 4) Estimated past irrigation demand before 1989 was from the study results of "Bulgaria Hydropower Study" by Electroworld Engineering Services Ltd. with Energoexport, 1994.

TABLE E.3.3 WATER CONSUMPTION BY INDUSTRY

No. from Top	Data No.	Location	Institution	Business	Water consumption			Water supply source		Basin
					Amount (1000 m ³ /yr)	Accumulated amount (1000 m ³ /yr)	Percent.	Municipal water supply system	Own source	
1	209	Belovo	"Rila" - WPS	Electricity	118,650	118,650	38.3%		Y	MU1
2	70	Stamboliiski	"Tzelhart" Ltd.	Pulp and paper	30,240	148,890	48.1%		Y	MM1
3	65	Dimitrovgrad	SC Neohim	Chemicals	21,040	169,930	54.9%	Y	Y	MM3
4	43	Stara Zagora	"Agroblohm"	Chemical	21,028	190,958	61.7%	Y	Y	SAZ
5	151	Plovdiv	"KCM" Ltd.	Lead, cooper	15,226	206,184	66.6%		Y	MM1
6	208	Belovo	KMH "Belovo" Ltd.	Pulp and paper	13,718	219,902	71.0%		Y	MU1
7	12	Galabovo	TEPS "Maritza East" 1	Electric Power	10,006	229,908	74.3%	Y	Y	SAZ
8	61	Dimitrograd	TEPS: Maritza 3	Power Plant	6,041	235,949	76.2%	Y	Y	MM3
9	178	Pazardjik	"Maritza" KK Ltd.	Food processing	5,120	241,069	77.9%		Y	MU2
10	229	Pestera	"Biovet" Ltd.	Pharmaceutical	5,100	246,169	79.5%	Y	Y	STA
11	74	Parvomai	"Bulcons" Ltd.	Food processing	4,025	250,194	80.8%		Y	MM2
12	87	Stamboliiski	"Vitamina" Ltd.	Food processing	3,324	253,518	81.9%		Y	MM1
13	153	Asenovgrad	"Askon" Ltd.	Food processing	3,100	256,618	82.9%		Y	CPE
14	134	Plovdiv	"Toplofikacia Plovdiv-north" Ltd.	Electric Power	2,861	259,479	83.8%	Y	Y	MM1
15	180	Pazardjik	"Trakie papir" Ltd.	Pulp and paper	2,557	262,036	84.6%	Y	Y	MU2
16	42	Stara Zagora	"Biser Oliva" Ltd.	Food processing	2,490	264,526	85.4%		Y	SAZ
17	194	Panagjurishte	"Opticoelektron"	Machinery	2,440	266,966	86.2%		Y	LUD
18	96	Sopot	"VMF Sopot"	Machinery	2,108	269,074	86.9%		Y	STR
19	77	Karlovo	"Agrotehnika" Ltd.	Machinery	1,900	270,974	87.5%		Y	STR
20	120	Plovdiv	"Kristal 91" sweet factory	Food processing	1,728	272,702	88.1%	Y	Y	MM1
21	3	Stara Zagora	"Zagorka" Brewery Ltd	Food processing	1,562	274,264	88.6%	Y		SAZ
22	44	Haskovo	Joint Ind WWTP - "Aslika", "Mesokombiant", "Vinprom", "Bulgaricum Alom", "KZ" SIB		1,559	275,823	89.1%	Y	Y	HAR
23	76	Rakovski	"Stomanoleene" Ltd.	Machinery	1,410	277,233	89.5%		Y	MM2
24	121	Plovdiv	"Mletchna promishlenost"	Food processing	1,256	278,489	89.9%	Y	Y	MM1
25	179	Pazardjik	"Kautchuk" Ltd.	Chemical	1,200	279,689	90.3%	Y	Y	MU2
26	169	Plovdiv	"Druzba" Ltd.	Glass	1,156	280,845	90.7%		Y	MM1
27	156	Asenovgrad	"Asenova krepost" Ltd.	Chemical	1,085	281,930	91.1%	Y	Y	CPE
28	193	Panagjurishte	"Oborishte" Ltd.	Textile	1,080	283,010	91.4%		Y	LUD
29	119	Katuniza	"Kristal 91"	Food processing	1,053	284,063	91.7%		Y	MM2
30	13	Mednikarovo	TEPS "Maritza East" 3	Electric Power	1,043	285,106	92.1%		Y	SAZ
31	181	Pazardjik	"Informacionni sistemi" Ltd.	Electronic	1,002	286,108	92.4%		Y	MU2
32	191	Tchepino	"Tchepino transport"	Transport	930	287,038	92.7%	Y	Y	CPI
33	189	Velingrad	"Kristal" Ltd.	Chemical	874	287,913	93.0%	Y	Y	CPI
34	28	Radnevo	"Maritza East Mines" Troianovo north	Coal Mine	840	288,753	93.3%	Y	Y	SAZ
35	14	Kovathevo	TEPS "Maritza East" 2	Electric Power	778	289,531	93.5%		Y	SAZ
36	188	Velingrad	COSM	Building materials	755	290,286	93.8%	Y	Y	CPI
37	17	Stara Zagora	BSR	Transport	736	291,022	94.0%	Y	Y	SAZ
38	71	Karlovo	"Karlovska Koprina" Ltd.	Textile	717	291,739	94.2%	Y	Y	STR
39	45	Haskovo	Manuella	Textile	688	292,427	94.4%		Y	HAR
40	170	Plovdiv	"Alen mack" Ltd.	Cosmetics	632	293,059	94.7%	Y	Y	MM1
41	30	Radnev	"Maritza East Mines" Troianovo" 1	Coal Mine	624	293,683	94.9%		Y	SAZ
42	21	Radnevo	"Remotex" Ltd.	Machinery	593	294,276	95.0%	Y	Y	SAZ
43	114	Plovdiv	"Plovdivska konserva" dep.3	Food processing	530	294,806	95.2%	Y	Y	MM1
44	223	Septemvri	"Steel pipes"	Machinery	500	295,306	95.4%	Y		MU1
45	79	Plovdiv	"Agris" Ltd.	Chemical	470	295,776	95.5%		Y	MM1
46	162	Plovdiv	"Pulpudeva" Ltd.	Tannery	418	296,194	95.7%		Y	MM1
47	184	Pazardjik	"Mletchna promishlenost" Ltd.	Food processing	412	296,606	95.8%		Y	MU2
48	1	Stara Zagora	DZU	Machinery	409	297,015	95.9%	Y	Y	SAZ
49	6	Stara Zagora	"Peiko Enev" (Can Factory) Ltd	Food processing	401	297,416	96.1%	Y	Y	SAZ
50	25	Stara Zagora	"Preskov"	Machinery	371	297,787	96.2%	Y	Y	SAZ
Other industries					11,830	309,617	100%			

Data source: NCESD etc.

TABLE E.3.4 WATER DEMAND OF ANIMAL BREEDING BY BASINS

1 NUMBER OF ANIMALS IN THE RIVER BASINS

(Unit: animal)

Basin	Cattle			Sheep			Pig			Fowl		
	Year			Year			Year			Year		
	1989	1992	1994	1989	1992	1994	1989	1992	1994	1989	1992	1994
CPE	8597	7055	5519	38157	30043	16125	6433	4647	3238	74984	60275	81340
CPI	7962	8174	7155	45733	35601	18095	7106	7009	3960	50546	57013	40192
HAR	17618	13325	8696	83004	60681	33346	26020	23068	10971	974464	242886	108184
LUD	9594	8065	3088	56431	43288	19691	34249	19907	16185	83235	68642	62425
MD	22143	18549	9593	145252	122681	60234	59399	49897	39091	243142	137296	164092
MM1	29543	23500	10351	130788	111648	56979	269155	164049	125042	475263	366840	276960
MM2	39685	32607	19589	174564	133351	57874	44513	42130	24628	327231	277153	329277
MM3	32349	30449	18251	118616	104239	53760	56878	48031	24678	944835	442491	416907
MU1	20224	17422	6717	111295	91532	49627	22721	13204	8882	163039	107549	117122
MU2	9354	7801	3370	50742	40364	18636	57496	35174	27904	129600	105522	101019
PYA	4729	4116	2188	38409	27192	14778	24164	13271	8557	43168	31260	36119
SAZ	62685	54363	29035	273269	228461	138431	178936	122538	93341	2396061	997480	583542
STA	2727	2651	1509	22114	15261	5326	5760	2353	1446	32956	28385	30066
STR	21854	21741	13409	139112	115117	56145	36195	26756	15860	182349	133038	165388
TOP	13705	12368	8891	74976	65220	40269	26989	16433	14679	122419	100392	121940
VAC	10537	9590	8146	52008	40691	21132	9518	6929	3940	115296	99843	128651
Total	313307	271776	155506	1554471	1265369	660447	865531	595395	422402	6358589	3256065	2763225

*: Percentage of number of animals in year of 1994 based on year of 1989

2 UNIT WATER REQUIREMENT

	(litter/animal/day)		
	Drinking	Cleaning	Total
Cattle	56.5	24.0	80.5
Sheep	7.5		7.5
Pig	25.0	85.0	110.0
Fowl	1.5		1.5

- Note: 1) Cattle is supposed to be composed of milk cow (50 %) and beef cow (50 %).
 2) Unit drinking water requirement of cow is supposed to be as follows:
 Milk cow: about 75 l/animal/day
 Beef cow: about 38 l/animal/day

3 WATER CONSUMPTION BY ANIMALS

(Unit: 1000 m3/year)

Basin	Cattle			Sheep			Pig			Fowl			Total water consumption		
	Year			Year			Year			Year			Year		
	1989	1992	1994	1989	1992	1994	1989	1992	1994	1989	1992	1994	1989	1992	1994
CPE	253	208	162	104	82	44	258	187	130	41	33	45	656	511	381
CPI	234	241	210	125	98	50	285	282	159	28	31	22	672	652	441
HAR	518	393	256	227	167	91	1045	929	440	534	133	59	2323	1621	846
LUD	282	238	91	154	119	54	1375	801	650	46	38	34	1857	1196	829
MD	651	547	282	398	337	165	2385	2009	1570	133	75	90	3566	2967	2106
MM1	868	692	304	358	306	156	10807	6605	5020	260	201	152	12293	7805	5632
MM2	1166	961	576	478	366	158	1787	1696	989	179	152	180	3610	3175	1903
MM3	951	897	536	325	286	147	2284	1934	991	517	243	228	4076	3360	1903
MU1	594	513	197	305	251	136	912	532	337	89	59	64	1900	1355	734
MU2	275	230	99	139	111	51	2308	1416	1120	71	58	55	2793	1815	1326
PYA	139	121	64	105	75	40	970	534	344	24	17	20	1238	747	468
SAZ	1842	1602	853	748	627	379	7184	4933	3748	1312	548	319	11086	7710	5299
STA	80	78	44	61	42	15	231	95	58	18	16	16	390	230	133
STR	642	641	394	381	316	154	1453	1077	637	100	73	91	2576	2107	1275
TOP	403	364	261	205	179	110	1084	662	589	67	55	67	1759	1260	1028
VAC	310	283	239	142	112	58	382	279	158	63	55	70	897	728	526
Total	9206	8007	4569	4255	3473	1808	34751	23971	16959	3481	1788	1513	51694	37239	24849

TABLE E.3.5 WATER DEMAND AND SUPPLY FROM SURFACE WATER AND GROUNDWATER

1 Water Demand in Year 1995 (average year)

(Unit: 1000 m3/Year)

No.	Water Demand	Estimated Demand			Estimated Supplied Amount		
		Surface water	Groundwater	Total	Surface water	Groundwater	Total
1	Irrigation water demand (IR)	312,428		312,428	2,549,108		2,549,108
1)	State irrigation	260,357		260,357	2,124,257		2,124,257
2)	Cooperative irrigation	52,071		52,071	424,851		424,851
2	Hydropower	0		0	0		0
1)	Demand (HD)	736,706		736,706	736,706		736,706
2)	Outflow	-736,706		-736,706	-736,706		-736,706
3	Domestic water supply (DW)	7,632	145,004	152,636	9,928	188,638	198,566
4	Industrial water supply (IW)	15,481	294,135	309,616	15,481	294,135	309,616
5	Animal breeding (AW)	1,242	23,607	24,849	1,242	23,607	24,849
	Gross Demand (GD)	1,073,489	462,746	1,536,235	3,312,466	506,380	3,818,846
	Percentage	69.9%	30.1%	100%	86.7%	13.3%	100%
	Net Demand (ND)	336,783	462,746	799,529	2,575,760	506,380	3,082,140
	Percentage	42.1%	57.9%	100%	83.6%	16.4%	100%

2 Water Demand in 1994 (4-year drought)

(Unit: 1000 m3/Year)

No.	Water Demand	Estimated Demand			Estimated Supplied Amount		
		Surface water	Groundwater	Total	Surface water	Groundwater	Total
1	Irrigation water demand	353,877		353,877	1,842,740		1,842,740
1)	State irrigation	294,898		294,898	1,535,617		1,535,617
2)	Cooperative irrigation	58,980		58,980	307,123		307,123
2	Hydropower	0		0	0		0
1)	Demand	550,496		550,496	128,993		128,993
2)	Outflow	-550,496		-550,496	-128,993		-128,993
2	Domestic water supply	7,632	145,004	152,636	9,928	188,638	198,566
3	Industrial water supply	15,481	294,135	309,616	15,481	294,135	309,616
4	Animal breeding	1,242	23,607	24,849	1,242	23,607	24,849
	Gross Demand (GD)	928,728	462,746	1,391,474	1,998,385	506,380	2,504,765
	Percentage	66.7%	33.3%	100%	79.8%	20.2%	100%
	Net Demand (ND)	378,232	462,746	840,978	1,869,392	506,380	2,375,772
	Percentage	45.0%	55.0%	100%	78.7%	21.3%	100%

Note: Proportions of surface water and groundwater were set as follows;

- State irrigation: Almost all water (about 100 %) supplied by surface water
Supplied water in 1996 was used for the supplied water amount in 1995.
- Cooperative irrigation: - ditto -
Demand and supplied amount was supposed to be 20 (%) of those of state irrigation systems
- Domestic water supply: 5 (%) from surface water and 95 (%) from groundwater
- Industrial water supply: 5 (%) from surface water and 95 (%) from groundwater
- Animal breeding: 5 (%) from surface water and 95 (%) from groundwater

TABLE E.4.1 MONTHLY RUNOFF POTENTIAL OF NATURAL CONDITION

1 Year 1994

Number	River	Catchment Area (km ²)	Runoff Volume (1000 m ³)												Annual	
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
1	MARITZA MAIN STREAM	8,323														
MU1	Upper sub-basin	1,173	13,617	16,209	18,631	43,026	54,188	28,347	36,957	378	30,932	37,477	25,951	37,896	343,608	
MU2	Lower sub-basin	429	6,516	9,921	14,980	22,698	1,712	3,642	1,094	337	710	23,187	11,462	15,266	111,526	
MM1	Upper Sub-basin	1,518	15,128	30,305	43,054	69,081	14,925	12,581	8,455	9,184	3,329	52,644	28,141	51,688	338,516	
MM2	Middle sub-basin	1,993	18,708	49,791	57,203	99,299	15,434	45,385	19,595	13,489	8,482	97,866	35,107	67,730	528,089	
MM3	Lower sub-basin	1,576	21,103	41,944	45,591	77,883	55,334	32,786	10,837	4,255	886	84,152	33,890	55,948	464,607	
MD	Downstream Basin of the Main Stream	1,634	20,499	25,737	47,270	82,911	70,856	35,428	23,373	5,637	0	92,063	45,683	65,523	514,980	
2	MAJOR TRIBUTARIES	12,991														
CPI	Chepinska River (right tributary)	919	11,442	9,695	21,442	31,990	30,385	18,912	31,249	15,444	816	5,877	10,938	38,066	226,256	
TOP	Topolniza River (left tributary)	1,857	19,888	30,082	38,939	81,626	45,406	34,044	25,396	5,240	7,461	71,702	20,290	44,122	424,198	
LUD	Luda Yana River (left tributary)	739	6,802	12,297	12,560	27,579	27,974	16,945	10,391	4,450	367	38,095	12,579	29,083	194,122	
STA	Stara River (right tributary)	366	6,090	4,427	9,441	16,156	12,557	8,783	14,383	1,858	1,638	3,934	6,230	17,950	103,446	
VAC	Vacha River (right tributary)	1,689	51,160	27,034	51,395	80,513	21,542	27,848	91,105	16,469	17,988	39,438	14,451	56,774	495,716	
PYA	Pyassachnik River (left tributary)	419	4,253	6,391	8,398	20,569	16,626	9,093	8,171	1,566	2,118	24,266	7,109	18,314	126,875	
CPE	Chepelarska River (right tributary)	979	20,915	18,373	27,490	58,109	50,174	49,999	35,218	2,332	601	32,830	17,191	44,084	357,315	
STR	Stryama River (left tributary)	1,694	16,627	25,696	49,661	97,805	21,856	6,437	30,092	8,633	6,861	70,725	23,392	55,697	413,482	
SAZ	Sazliyka River (left tributary)	3,343	31,441	24,828	86,704	162,543	22,552	40,464	47,524	11,914	-2,353	86,196	51,776	118,703	687,000	
HAR	Harmanlyska River (right tributary)	986	17,361	30,676	36,746	52,260	39,878	19,929	7,557	3,362	759	69,292	29,895	41,649	349,374	
3	JUNCTION POINTS															
Jct.1	Most downstream point of Maritza R.	21,314	190,853	254,074	384,994	675,758	168,051	212,479	227,015	137,045	47,075	552,109	230,096	457,117	3,536,665	
Jct.2	Jct. at Maritza R. with Sazliyka R.	18,694	172,045	225,453	340,840	606,466	155,488	182,198	211,169	130,915	50,662	467,434	189,346	401,792	3,133,808	
Jct.3	Jct. at Maritza R. with Stryama R.	13,775	142,264	190,495	260,926	459,909	138,690	138,867	175,180	247	52,547	366,766	144,012	294,568	2,364,471	
Jct.4	Jct. at Maritza R. with Pyassachnik R.	11,782	133,110	159,406	226,878	401,247	130,193	108,510	166,596	4,699	45,303	308,671	122,662	253,617	2,060,892	
Jct.5	Jct. at Maritza R. with Stara R.	5,483	59,764	84,605	106,466	188,900	82,381	58,348	70,039	18,786	32,461	170,374	69,341	119,839	1,061,303	
Jct.6	Jct. at Maritza R. with Chepinska R.	2,092	32,218	41,044	52,151	84,329	42,077	20,577	47,021	11,148	30,814	66,090	35,947	58,113	521,527	

2 Year 1995

Number	River	Catchment Area (km ²)	Runoff Volume (1000 m ³)												Annual
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
1	MARITZA MAIN STREAM	8,323													
MU1	Upper sub-basin	1,173	37,151	7,478	48,423	22,714	62,531	51,549	57,727	18,854	13,458	1,194	11,316	83,805	416,201
MU2	Lower sub-basin	429	22,338	8,202	29,416	5,611	5,420	10,170	12,319	5,268	5,788	2,137	8,177	20,670	135,517
MM1	Upper Sub-basin	1,518	82,275	26,712	106,379	14,930	5,326	46,332	21,667	12,259	20,986	7,838	24,999	61,983	431,687
MM2	Middle sub-basin	1,993	90,668	34,706	124,180	38,507	4,856	59,401	37,748	8,198	27,719	8,811	38,788	90,932	564,536
MM3	Lower sub-basin	1,576	103,467	36,594	121,877	39,073	21,187	-3,302	22,928	10,678	34,992	9,043	38,081	63,029	504,251
MD	Downstream Basin of the Main Stream	1,634	139,828	41,336	128,937	58,420	42,826	21,413	5,819	6,709	32,219	13,080	74,520	53,510	618,617
2	MAJOR TRIBUTARIES	12,991													
CPI	Chepinska River (right tributary)	919	31,899	7,726	34,221	20,852	42,691	34,978	44,116	13,977	13,052	15,014	16,976	50,011	325,512
TOP	Topolniza River (left tributary)	1,857	69,383	29,367	78,598	39,127	90,331	68,206	58,637	27,989	28,832	11,825	40,767	82,578	625,639
LUD	Luda Yana River (left tributary)	739	28,541	2,626	28,927	11,996	42,336	40,950	28,189	13,457	10,469	641	13,879	46,989	269,000
STA	Stara River (right tributary)	366	14,027	3,749	17,730	9,170	17,864	24,576	18,669	6,420	4,784	6,201	7,619	21,571	152,381
VAC	Vacha River (right tributary)	1,689	75,438	36,722	109,365	43,850	30,033	148,197	58,374	19,908	21,203	9,803	40,149	66,469	659,510
PYA	Pyassachnik River (left tributary)	419	15,138	2,799	18,742	7,410	24,372	34,323	17,555	8,343	7,305	221	9,064	31,379	176,152
CPE	Chepelarska River (right tributary)	979	50,543	12,391	55,903	31,900	51,207	66,401	55,791	12,447	14,269	1,744	20,396	56,424	429,415
STR	Stryama River (left tributary)	1,694	47,307	19,452	79,744	16,590	30,237	122,539	35,002	22,903	25,747	7,962	34,341	83,104	533,928
SAZ	Sazliyka River (left tributary)	3,343	137,924	41,727	174,314	81,878	13,961	28,338	55,703	23,724	77,946	17,678	83,294	102,955	839,442
HAR	Harmanlyska River (right tributary)	986	90,397	31,632	110,539	34,663	25,844	12,922	4,103	9,159	27,236	8,816	31,460	37,740	424,511
3	JUNCTION POINTS														
Jct.1	Most downstream point of Maritza R.	21,314	693,269	244,911	852,085	292,341	169,243	409,592	295,635	127,248	238,474	79,121	320,557	571,586	4,294,062
Jct.2	Jct. at Maritza R. with Sazliyka R.	18,694	565,690	205,232	723,364	240,928	187,407	427,649	296,287	120,461	207,127	67,305	261,271	527,987	3,830,710
Jct.3	Jct. at Maritza R. with Stryama R.	13,775	419,335	159,237	544,877	163,989	193,103	426,795	253,668	101,377	134,157	51,119	185,016	434,150	3,066,823
Jct.4	Jct. at Maritza R. with Pyassachnik R.	11,782	365,051	138,423	469,713	140,543	194,932	395,453	233,264	98,231	117,727	46,132	161,949	380,071	2,741,490
Jct.5	Jct. at Maritza R. with Stara R.	5,483	186,333	67,280	221,822	75,574	143,537	142,087	136,995	57,344	62,385	24,139	80,947	211,994	1,410,436
Jct.6	Jct. at Maritza R. with Chepinska R.	2,092	88,413	31,774	110,080	34,364	51,110	54,023	70,263	23,870	27,519	10,150	30,454	107,548	639,566

TABLE E.4.2 MONTHLY DISTURBED RUNOFF POTENTIAL WITH MAJOR DAMS

1 Year 1994

Number	River	Catch Area (km ²)	Dams		Runoff Volume (1000 m ³)												
			Name of Dam	Upstream area (km ²)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1 MARITZA MAIN STREAM																	
MU1	Upper sub-basin	1,173	Belmecken: Be	22	23,371	27,003	29,100	49,269	55,841	35,323	50,529	17,338	44,125	49,812	35,834	48,612	466,157
MU2	Lower sub-basin	429			6,516	9,921	14,980	22,698	1,712	3,642	1,094	337	710	23,187	11,462	15,266	111,526
MM1	Upper Sub-basin	1,518			15,128	30,305	43,054	69,081	14,925	12,581	8,455	9,184	3,329	52,644	28,141	51,688	338,516
MM2	Middle sub-basin	1,993			18,708	49,791	57,203	99,299	15,434	45,385	19,595	13,489	8,482	97,866	35,107	67,730	528,089
MM3	Lower sub-basin	1,576			21,103	41,944	45,591	77,883	55,334	32,786	10,837	4,255	886	84,152	33,890	55,948	464,607
MD	Downstream Basin	1,634			20,499	25,737	47,270	82,911	70,856	35,428	23,373	5,637	0	92,063	45,683	65,523	514,980
2 MAJOR TRIBUTARIES																	
CPI	Chepinska River	919	Batak: Ba	68	12,955	12,649	22,532	31,396	37,255	36,557	57,119	37,648	8,953	8,766	13,582	38,266	319,676
TOP	Topolnitsa River	1,857	Topolnitsa: To	1,445	5,746	7,878	9,972	19,495	17,457	21,412	22,904	14,749	6,659	17,737	6,212	11,079	161,299
LUD	Luda Yana River	739			6,802	12,297	12,560	27,579	22,974	16,945	10,391	4,450	367	38,095	12,579	29,083	194,122
STA	Stara River	365			6,090	4,427	9,441	16,156	12,557	8,783	14,383	1,858	1,638	3,934	6,230	17,950	103,446
VAC	Vacha River	1,689	Krichim: Kr	1,447	11,059	18,351	17,355	33,091	23,101	28,761	42,903	30,755	16,109	24,699	15,363	18,235	278,782
PYA	Pyassachnik River	419	Pyassachnik: Py	345	751	1,129	1,483	3,633	2,936	6,606	9,243	7,577	2,474	4,486	1,256	3,231	41,808
CPE	Chepelarska River	979			20,915	18,373	27,490	58,109	50,174	49,999	35,218	2,332	601	32,830	17,191	44,084	357,315
STR	Stryama River	1,694			16,627	25,696	49,661	97,805	21,856	6,437	30,092	8,633	6,861	70,725	23,392	55,697	413,482
SAZ	Sazlyka River	3,343	Tundza Basin		33,652	26,577	89,212	165,573	28,965	53,633	12,416	28,011	6,485	89,232	54,449	121,079	769,286
HAR	Harmantyska River	986	Trakiets: Tr	204	15,369	25,130	29,144	42,218	32,517	17,024	9,043	5,867	1,902	55,326	24,149	33,402	291,090
3 JUNCTION POINTS																	
Jct.1	Most downstream	21,314	Be, Ba, Kr, To, Py, Tr and Tundza Basin	3,531	180,477	244,983	348,541	598,371	386,698	263,840	314,715	223,233	87,314	501,488	223,914	409,968	3,583,542
Jct.2	Jct. at Maritza R. with Sazlyka R.	18,694	Be, Ba, Kr, To, Py and Tundza Basin	3,327	161,068	217,529	307,507	532,326	173,413	235,123	295,846	213,308	88,383	424,719	187,145	358,495	3,194,861
Jct.3	Jct. at Maritza R. with Stryama R.	13,775	Be, Ba, Kr, To and Py	3,327	125,335	174,937	222,725	379,593	144,378	177,509	230,236	89,782	82,462	315,622	138,054	249,257	2,329,889
Jct.4	Jct. at Maritza R. with Pyassachnik R.	11,782	Be, Ba, Kr, To and Py	3,327	112,953	144,844	187,631	318,706	132,614	150,051	216,220	92,967	75,116	258,947	116,849	207,834	2,015,433
Jct.5	Jct. at Maritza R. with Stara R.	5,483	Be, Ba and To	1,535	56,735	76,892	91,489	146,224	78,488	84,424	110,148	67,426	50,347	140,868	65,460	102,023	1,070,525
Jct.6	Jct. at Maritza R. with Chepinska R.	2,092	Be and Ba	90	43,201	54,047	63,402	89,524	52,054	48,244	87,446	50,982	51,458	79,609	48,222	70,057	738,245

2 Year 1995

Number	River	Catch Area (km ²)	Dams		Runoff Volume (1000 m ³)												
			Name of Dam	Upstream area (km ²)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1 MARITZA MAIN STREAM																	
MU1	Upper sub-basin	1,173	Belmecken: Be	22	48,778	17,002	57,417	30,034	62,738	53,864	64,280	39,846	25,565	7,616	45,458	104,577	547,177
MU2	Lower sub-basin	429			22,338	8,202	29,416	5,611	5,420	10,170	12,319	5,268	5,788	2,137	8,177	20,670	135,517
MM1	Upper Sub-basin	1,518			82,275	26,712	106,379	14,930	5,326	46,332	21,667	12,259	20,986	7,838	24,999	61,983	431,687
MM2	Middle sub-basin	1,993			90,668	34,706	124,180	38,507	4,856	59,401	37,748	8,198	27,719	8,811	38,788	90,952	564,536
MM3	Lower sub-basin	1,576			103,467	36,594	121,877	39,073	21,187	3,302	22,928	10,678	34,992	9,043	38,081	63,029	504,251
MD	Downstream Basin	1,634			139,828	41,336	128,937	58,420	42,826	21,413	5,819	6,709	32,219	13,080	74,520	53,510	618,617
2 MAJOR TRIBUTARIES																	
CPI	Chepinska River	919	Batak: Ba	68	32,578	8,266	35,403	24,046	45,238	44,718	58,539	36,035	22,282	20,963	28,931	56,008	413,008
TOP	Topolnitsa River	1,857	Topolnitsa: To	1,445	16,690	7,483	18,512	9,719	25,838	45,874	41,908	40,463	17,084	9,084	10,530	19,660	262,846
LUD	Luda Yana River	739			28,541	2,626	28,927	11,996	42,336	40,950	28,189	13,457	10,469	641	13,879	46,989	269,000
STA	Stara River	366			14,027	3,749	17,730	9,170	17,861	24,576	18,669	6,420	4,784	6,201	7,619	21,571	152,381
VAC	Vacha River	1,689	Krichim: Kr	1,447	26,338	9,075	26,414	55,245	49,305	56,886	41,430	33,728	18,558	17,305	56,323	39,575	433,182
PYA	Pyassachnik River	419	Pyassachnik: Py	345	2,674	406	3,310	1,309	4,304	6,062	3,100	1,773	1,890	439	1,601	5,542	32,410
CPE	Chepelarska River	979			50,543	12,391	55,903	31,900	51,207	66,401	55,791	12,447	14,269	1,734	20,396	56,424	429,415
STR	Stryama River	1,694			47,307	19,452	79,744	16,590	39,237	122,539	35,002	22,903	25,747	7,962	34,341	83,104	533,928
SAZ	Sazlyka River	3,343	Tundza Basin		140,201	43,344	176,261	82,571	18,482	40,021	75,413	44,276	86,275	22,085	86,744	114,958	930,639
HAR	Harmantyska River	986	Trakiets: Tr	204	72,084	25,538	88,179	28,131	21,977	14,148	7,564	11,924	24,291	8,492	25,817	30,852	358,997
3 JUNCTION POINTS																	
Jct.1	Most downstream	21,314	Be, Ba, Kr, To, Py, Tr and Tundza Basin	3,531	613,274	221,964	738,814	307,726	205,091	439,324	360,966	231,245	259,348	108,186	371,390	553,248	4,410,577
Jct.2	Jct. at Maritza R. with Sazlyka R.	18,694	Be, Ba, Kr, To, Py and Tundza Basin	3,327	493,306	183,643	614,113	258,597	214,415	410,560	350,321	218,126	225,695	95,265	314,993	503,693	3,912,727
Jct.3	Jct. at Maritza R. with Stryama R.	13,775	Be, Ba, Kr, To and Py	3,327	350,244	136,336	438,710	186,864	204,349	405,718	282,689	176,758	151,117	75,039	239,952	392,723	3,040,499
Jct.4	Jct. at Maritza R. with Pyassachnik R.	11,782	Be, Ba, Kr, To and Py	3,327	294,157	114,894	362,510	163,339	197,772	365,789	257,683	170,358	133,846	69,371	215,840	336,178	2,681,738
Jct.5	Jct. at Maritza R. with Stara R.	5,483	Be, Ba and To	1,535	150,828	60,189	174,412	67,937	116,236	148,664	152,864	109,980	78,162	37,347	107,337	186,025	1,389,978
Jct.6	Jct. at Maritza R. with Chepinska R.	2,092	Be and Ba	90	99,973	41,184	118,960	45,368	55,997	67,309	92,563	57,280	48,890	23,219	76,710	134,962	862,414

TABLE E.4.3 ANNUAL POTENTIAL OF TOTAL WATER RESOURCES

1 Water Resources Potential of Average Year (Level of Year 1995)

No.	Junctions	Catchment Area	Annual Precipitation	Maximum Potential	Evapo-transpiration Loss	Infiltration Loss	Total Loss	Surface Water Potential	Groundwater Recharge Potential	Total Potential
		A	R	MP	EL	IL	TL	PS	PG	PT
		(km ²)	(mm/yr)	(1000 m ³ /yr)	(1000 m ³ /yr)	(1000 m ³ /yr)	(1000 m ³ /yr)	(1000 m ³ /yr)	(1000 m ³ /yr)	(1000 m ³ /yr)
Jct.1	Most downstream point of Maritza R.	21,314	642.5	13,694,245	7,257,950	273,885	7,531,835	4,294,062	1,692,033	5,986,095
Jct.2	Jct. at Maritza R. with Sazliyka R.	18,694	638.8	11,941,727	6,245,484	405,551	6,651,034	3,830,710	1,459,983	5,290,693
Jct.3	Jct. at Maritza R. with Stryama R.	13,775	658.0	9,063,950	4,617,788	299,856	4,917,644	3,066,823	1,079,483	4,146,306
Jct.4	Jct. at Maritza R. with Pyassachnik R.	11,782	669.2	7,884,514	3,960,129	257,151	4,217,280	2,741,490	925,744	3,667,234
Jct.5	Jct. at Maritza R. with Stara R.	5,483	646.1	3,542,566	1,641,740	106,607	1,748,347	1,410,436	383,783	1,794,220
Jct.6	Jct. at Maritza R. with Chepinska R.	2,092	644.9	1,349,131	546,365	35,478	581,843	639,566	127,722	767,288
Percentage of Potential at Jct.1				100%	53%	2%	55%	31%	12%	44%

2 Water Resources Potential of 4-Year Drought (Level of Year 1994)

No.	Junctions	Catchment Area	Annual Precipitation	Maximum Potential	Evapo-transpiration Loss	Infiltration Loss	Total Loss	Surface Water Potential	Groundwater Recharge Potential	Total Potential
		A	R	MP	EL	IL	TL	PS	PG	PT
		(km ²)	(mm/yr)	(1000 m ³ /yr)	(1000 m ³ /yr)	(1000 m ³ /yr)	(1000 m ³ /yr)	(1000 m ³ /yr)	(1000 m ³ /yr)	(1000 m ³ /yr)
Jct.1	Most downstream point of Maritza R.	21,314	504.2	10,746,519	5,695,655	214,930	5,910,585	3,536,665	1,297,774	4,834,438
Jct.2	Jct. at Maritza R. with Sazliyka R.	18,694	497.7	9,304,004	4,751,051	308,510	5,059,561	3,133,808	1,110,635	4,244,443
Jct.3	Jct. at Maritza R. with Stryama R.	13,775	507.3	6,988,058	3,560,162	231,179	3,791,341	2,364,471	832,246	3,196,717
Jct.4	Jct. at Maritza R. with Pyassachnik R.	11,782	503.0	5,926,346	2,976,400	193,273	3,169,673	2,060,892	695,782	2,756,673
Jct.5	Jct. at Maritza R. with Stara R.	5,483	486.2	2,665,835	1,235,489	80,227	1,315,716	1,061,303	288,816	1,350,119
Jct.6	Jct. at Maritza R. with Chepinska R.	2,092	525.9	1,100,183	445,565	28,933	474,498	521,527	104,158	625,685
Percentage of Potential at Jct.1				100%	53%	2%	55%	33%	12%	45%

Note:

- | | |
|---|------------------------------|
| 1) Maximum potential (MP): | $MP = A \times R$ |
| 2) Evapo-transpiration loss (EL): | $EL = (MP - SP) \times 0.77$ |
| 3) Infiltration Loss (IL): | $IL = (MP - PS) \times 0.05$ |
| 4) Groundwater recharge potential (PG): | $PG = MP - TL - PS$ |

TABLE E.6.1 EXISTING ACTIVITIES RELATING TO RIVER BASIN MANAGEMENT

Activity	Responsible agents
A. Control of Water Resources	
1) Meteo-hydrological and hydraulic observation	1) NIMH
2) Monitoring of groundwater	1) NIMH 2) Depart. "Protection and use of groundwater" of MoEW
3) Control of water use permit for surface water	1) Depart. "Protection and use of surface water" of MoEW
4) Control of water use permit for groundwater	1) Depart. "Protection and use of groundwater" of MoEW
5) Control of operation of major reservoirs	1) Depart. "Protection and use of surface water" of MoEW
6) Monitoring of floods	1) Civil Defense of Council of Ministers
7) Evacuation of people from floods	1) Civil Defense of Council of Ministers
8) Structural countermeasures for floods (river improvement)	1) Local commission for natural disasters and calamities
B. Control of Water Quality	
1) Monitoring of surface water quality	1) REIs with NCESD of MoEW 2) NIMH
2) Monitoring of groundwater quality	1) REIs with NCESD of MoEW 2) Depart. "Protection and use of groundwater" of MoEW 3) NIMH 4) Hygiene Epidemiology Inspection of MoH
3) Monitoring and regulation of industrial wastewater	1) REIs of MoEW
4) Collection and treatment of domestic wastewater including some industrial wastewater	1) VIKs
5) Monitoring of hazardous chemical and waste	1) Civil Defense of Council of Ministers
6) Evacuation of people from accidental pollution	1) Civil Defense of Council of Ministers with local committee for hazards
C. Conservation of Natural Environment	
1) Monitoring	1) Depart. "National nature protection service" of MoEW
2) Conservation of natural park, natural monument and biodiversity	- ditto -
D. Forest Management	
1) Monitoring	1) National Forestry Board of MoAFAR
2) Conservation, reforestation and control for production	- ditto -
E. Erosion Control and Soil Conservation	
1) Monitoring of erosion	1) National Forestry Board of MoAFAR 2) Civil Defense of Council of Ministers
2) Monitoring of soil erosion	1) Soil institute "Pushkarov" of Academy of Agriculture
3) Countermeasures for erosion	1) National Forestry Board of MoAFAR 2) Local committee for hazards
4) Guidance against soil erosion	1) Depart. "National Soil Service" of MoAFAR

TABLE E.6.2 EXISTING MONITORING NETWORKS IN THE MARITZA RIVER BASIN

Observation item		Climate/ rainfall	Surface- water		Ground- water		Soil	Forest	Nature (bio- diversity, scenery)	Remarks
Agency/Institute			Water level/ discharge	Quality	Water level/ discharge	Quality				
1	Bulgarian Academy of Science									
1-1	National Institute of Meteorology and Hydrology (NIMH)	X	X	X	X	X				National monitoring network
2	Ministry of Environment, Waters and Mineral Resources									
2-1	National Center of Environment and Sustainable Development (NCESD)		X (partly started in 1997)	X		X	X			National monitoring network
2-2	National Nature Protection Service							X		National monitoring network
2-3	Depart. "Protection and use of groundwater"				X	X				Supplemental monitoring system started since 1993/1994
4	Ministry of Agriculture, Forests and Agrarian Reform									
4-1	National Forestry Board						X	X	X	National monitoring network
4-2	Irrigation Systems Ltd.	X (rainfall only)	X		X					Monitoring network for irrigation systems including irrigation reservoirs
5	Academy of Agriculture									
5-1	Soil Institute "Pushkarov"						X			Supplemental monitoring system
6	Ministry of Energy									
6-1	Dam and Cascade Enterprise	X	X							Monitoring network for hydropower systems including multi-purpose reservoirs
7	Ministry of Health									
7	Hygiene Epidemiology Inspection				X					Monitoring for drinking water sources

TABLE E.6.3 SUMMARY OF WATER DEMAND WITH WATER SOURCES

1 Water Demand in Average Year (as a level of Year 1995)

1-1 Amount (Unit: 1000 m3/Year)

No.	Water Demand	Year 2015 (Case 1)		
		Surface water	Groundwater	Total
1	Irrigation water demand (IR)	1,041,426		1,041,426
1)	State irrigation	867,855		867,855
2)	Cooperative irrigation	173,571		173,571
2	Hydropower	0		0
1)	Demand (HD)	736,706		736,706
2)	Outflow	-736,706		-736,706
3	Domestic water supply (DW)	9,346	177,567	186,913
4	Industrial water supply (IW)	325,097	294,135	619,232
5	Animal breeding (AW)	1,242	23,607	24,849
	Total Demand (TD)	2,113,817	495,310	2,609,127
	Percentage	81.0%	19.0%	100%
	Net Demand (ND)	1,377,111	495,310	1,872,421
	Percentage	73.5%	26.5%	100%

2 Water Demand in 4-Year Drought (as a level of Year 1994)

2-1 Amount (Unit: 1000 m3/Year)

No.	Water Demand	Year 2015 (Case 1)		
		Surface water	Groundwater	Total
1	Irrigation water demand	1,179,590		1,179,590
1)	State irrigation	982,992		982,992
2)	Cooperative irrigation	196,598		196,598
2	Hydropower	0		0
1)	Demand	550,496		550,496
2)	Outflow	-550,496		-550,496
2	Domestic water supply	9,346	177,567	186,913
3	Industrial water supply	325,097	294,135	619,232
4	Animal breeding	1,242	23,607	24,849
	Total Demand (TD)	2,065,771	495,310	2,561,081
	Percentage	80.7%	19.3%	100%
	Net Demand (ND)	1,515,275	495,310	2,010,585
	Percentage	75.4%	24.6%	100%

Case 1 in 2015: Utilization rate of state irrigation systems is 50 (%).

Proportions of surface water and groundwater were set as follows;

State irrigation: Almost all (about 100 %) is supplied by surface water.

Cooperative irrigation: - ditto -

Domestic water supply: 5 (%) from surface water and 95 (%) from groundwater.

Industrial water supply: 5 (%) from surface water and 95 (%) from groundwater in the present.

Increased water demand is supplied by surface water.

Animal breeding: 5 (%) from surface water and 95 (%) from groundwater.

TABLE E.6.4 ITEMS OF WATER RESOURCES MANAGEMENT (1/2)
- Strengthening of Monitoring System

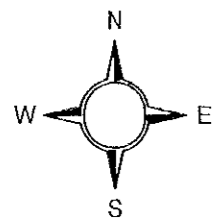
Item	Contents to be considered	Major target areas
1	Meteo-hydrology	
1) Climate and rainfall	<ul style="list-style-type: none"> ■ Existing numbers and distribution of stations is sufficient. ■ Further improvement of data collection and data base system 	<ul style="list-style-type: none"> ■ Maritza River Basin ■ Surrounding basins
2) Water level and discharge in rivers	<ul style="list-style-type: none"> ■ Increase numbers of station along Maritza main stream and major tributaries ■ Further improvement of data collection and data base system 	<ul style="list-style-type: none"> ■ Maritza main stream ■ Major tributaries
2	Groundwater	
	<ul style="list-style-type: none"> ■ Improvement of the data quality of national monitoring network ■ Coordination with regional monitoring networks of former CoG and MoH ■ Further improvement of data collection and data base systems for national monitoring network and regional networks 	<ul style="list-style-type: none"> ■ Maritza River Basin
3	Forest area for water source	
	<ul style="list-style-type: none"> ■ Establishment of global monitoring system by using satellite image etc. ■ Incorporation of the information of MoAFAR 	<ul style="list-style-type: none"> ■ CPI, STA, VAC, CPE, MUI, TOP and MD
4	Water usage	
1) Hydropower systems	<ul style="list-style-type: none"> ■ Further improvement of monitoring of intake water, inflow and outflow of reservoirs and discharge to HPPs ■ Further improvement of monitoring of diversion water from/to neighboring basins 	<ul style="list-style-type: none"> ■ Belmeken-Sestrimo-Chaira, Batak, Dospat-Vacha Schemes
2) Irrigation systems	<ul style="list-style-type: none"> ■ Improvement of monitoring of reservoir balance ■ Improvement of monitoring for intake water from HPPs and weirs ■ Improvement of monitoring discharge along major canals 	<ul style="list-style-type: none"> ■ Aleko Pazardjik , Topolnitza, Krichim Cheshnigirovo, Stryama Chirpan, Stara Zagora, Nova Zagora, Trakietz ISs and others
3) Domestic and industrial water supply	<ul style="list-style-type: none"> ■ Establishment of monitoring system for intake surface water ■ Improvement of monitoring of groundwater extraction 	<ul style="list-style-type: none"> ■ Maritza River Basin
5	Floods and sediment	
	<ul style="list-style-type: none"> ■ Monitoring of flood area ■ Monitoring of sediment discharge, sediment deposit and erosion 	

TABLE E.6.4 ITEMS OF WATER RESOURCES MANAGEMENT (2/2)
- Management Activity

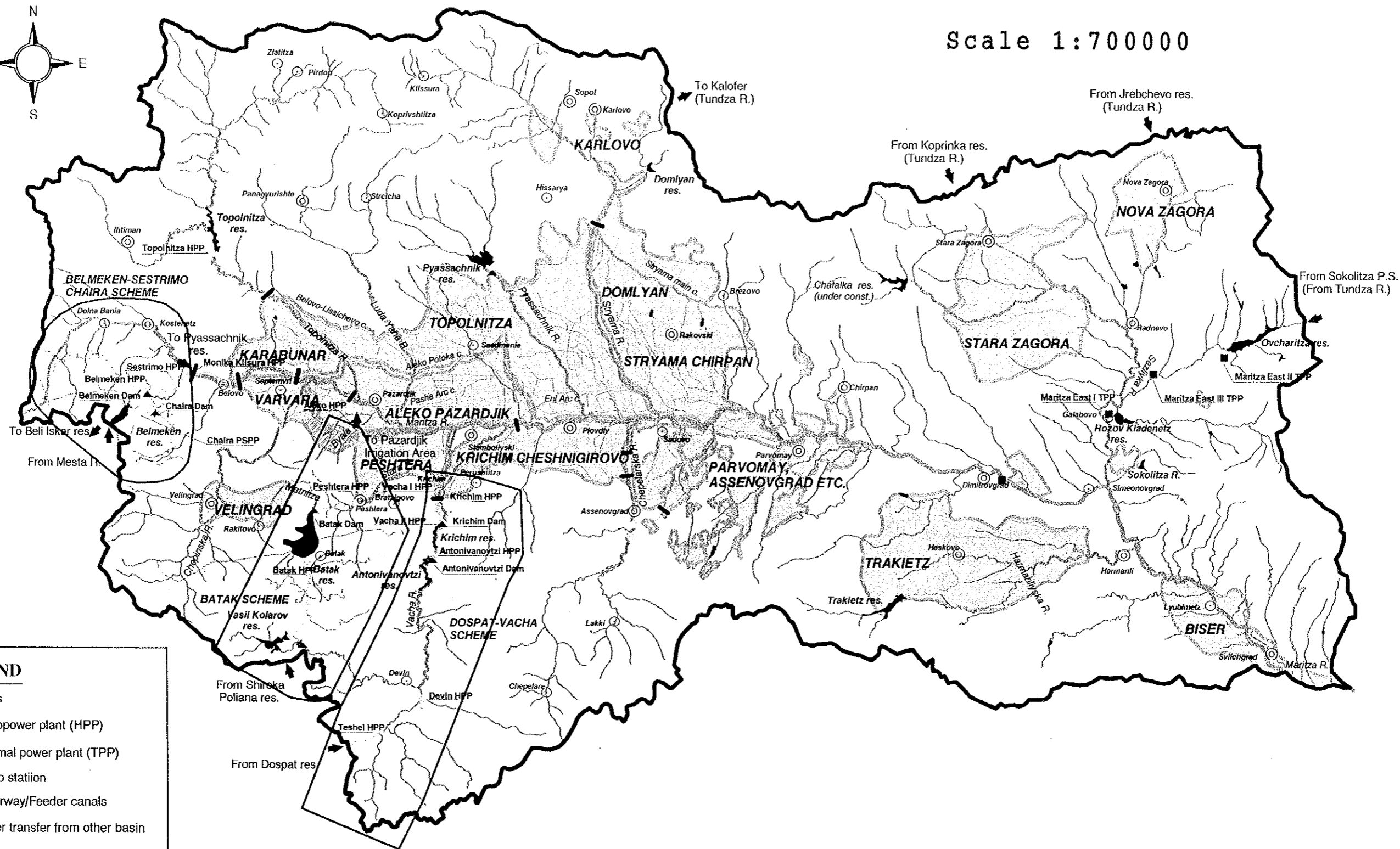
Item	Contents to be considered	Major target areas
1 Conservation of Forest Area for Water Source	<ul style="list-style-type: none"> ■ Identification of conservation forest area ■ Coordination with MoAFAR 	<ul style="list-style-type: none"> ■ CPI, STA, VAC, CPE, MUI, TOP and MD
2 Control of Water Usage		
1) Irrigation	<ul style="list-style-type: none"> ■ Evaluation of request of water usage based on real water demand ■ Water use permit for optimum irrigation water demand ■ Monitoring and regulation of water use 	<ul style="list-style-type: none"> ■ Major irrigation systems and others
2) Hydropower	<ul style="list-style-type: none"> ■ Evaluation of request of water usage based on real water demand ■ Water use permit for optimum hydropower water demand ■ Monitoring and regulation of water use 	<ul style="list-style-type: none"> ■ Hydropower systems in the Maritza River Basin
3) Domestic and industrial water supply	<ul style="list-style-type: none"> ■ Evaluation of request of water usage based on real water demand ■ Water use permit for optimum demand for water supply ■ Monitoring and regulation of water use 	<ul style="list-style-type: none"> ■ Water supply systems and industries
3 Control of Optimum Operation of Hydraulic Structures	<ul style="list-style-type: none"> ■ Setting reservoir operation schedule based on optimum water demand ■ Setting operation schedule of intake water by major intake facilities based on optimum water demand ■ Adjustment of operation schedule based on monitoring results 	<ul style="list-style-type: none"> ■ Major reservoirs ■ Major intake weirs and facilities
5. Organization and Institutional Aspects	<ul style="list-style-type: none"> ■ Establishment of a basin authority for combined river basins for the Maritza River with surrounding basins 	<ul style="list-style-type: none"> ■ Maritza River Basin and others
6. Cost Recovery for Management	<ul style="list-style-type: none"> ■ National budget ■ Cost recovery from user of water 	<ul style="list-style-type: none"> ■ Maritza River Basin and others
7. Necessary Study		
1) Water resources management study in Bulgaria	<ul style="list-style-type: none"> ■ Updating water resources potential, water demand and water balance in Bulgaria ■ Updating necessary and sufficient water diversion from/to neighboring basins in Bulgaria ■ Study for Struma, Mesta, Arda and Tundza River Basins ■ Sustainability from aspects of natural environment and socio-economy 	<ul style="list-style-type: none"> ■ Whole Bulgaria ■ Struma, Mesta, Iskar and Tundza River Basins
2) Rehabilitation and improvement of irrigation systems in Maritza River Basin	<ul style="list-style-type: none"> ■ Rehabilitation ■ Improvement of facilities incl. dams, intake weirs and canals ■ Operation and maintenance of facilities ■ Detailed monitoring networks ■ Tariff system ■ Economic and financial feasibility ■ Environmental aspects 	<ul style="list-style-type: none"> ■ Irrigation systems in the Maritza River Basin
3) Water balance of hydropower systems	<ul style="list-style-type: none"> ■ Further improvement of reservoir operation and HPP operation 	<ul style="list-style-type: none"> ■ Hydropower schemes in the Maritza River Basin
4) Rehabilitation of water supply systems	<ul style="list-style-type: none"> ■ Rehabilitation of water supply facilities ■ Tariff system 	<ul style="list-style-type: none"> ■ Water supply systems in the Maritza River Basin

TABLE E.6.5 PROPOSED STAGED PROGRAM OF RIVER BASIN MANAGEMENT

No.	Item	Preparation Year 1999 - 2000	Short term Year 2001 - 2005	Medium term Year 2006 - 2010	Long term Year 2011 - 2015	After Year 2016
1.	Strengthening of monitoring systems					
1-1	Meteo-hydrology					
1-2	Water intake for irrigation					
1-3	Water intake for hydropower					
1-4	Artificial control of surface water resources					
1-5	Water intake for domestic water supply					
1-6	Water intake for industry		Top 50 factories	Top 51-100	Other factories	(Continue)
2.	Conservation and increase forest area for water resources		Investigation	Priority basins	Other basins	(Continue)
3.	Relating studies					
3-1	Water resources management study in Bulgaria					
3-2	Agricultural development in the Maritza River Basin		1st priority groups	2nd priority groups	3rd priority groups	
	Implementation of agricultural development (for reference)			1st priority groups	2nd priority groups	3rd priority groups
3-3	Water balance of hydropower systems					
	Operation of hydropower systems based on the water balance study (for reference)					
3-4	Rehabilitation of water supply systems					
	Implementation of rehabilitation of water supply systems (for reference)					



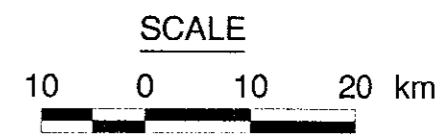
Scale 1:700000

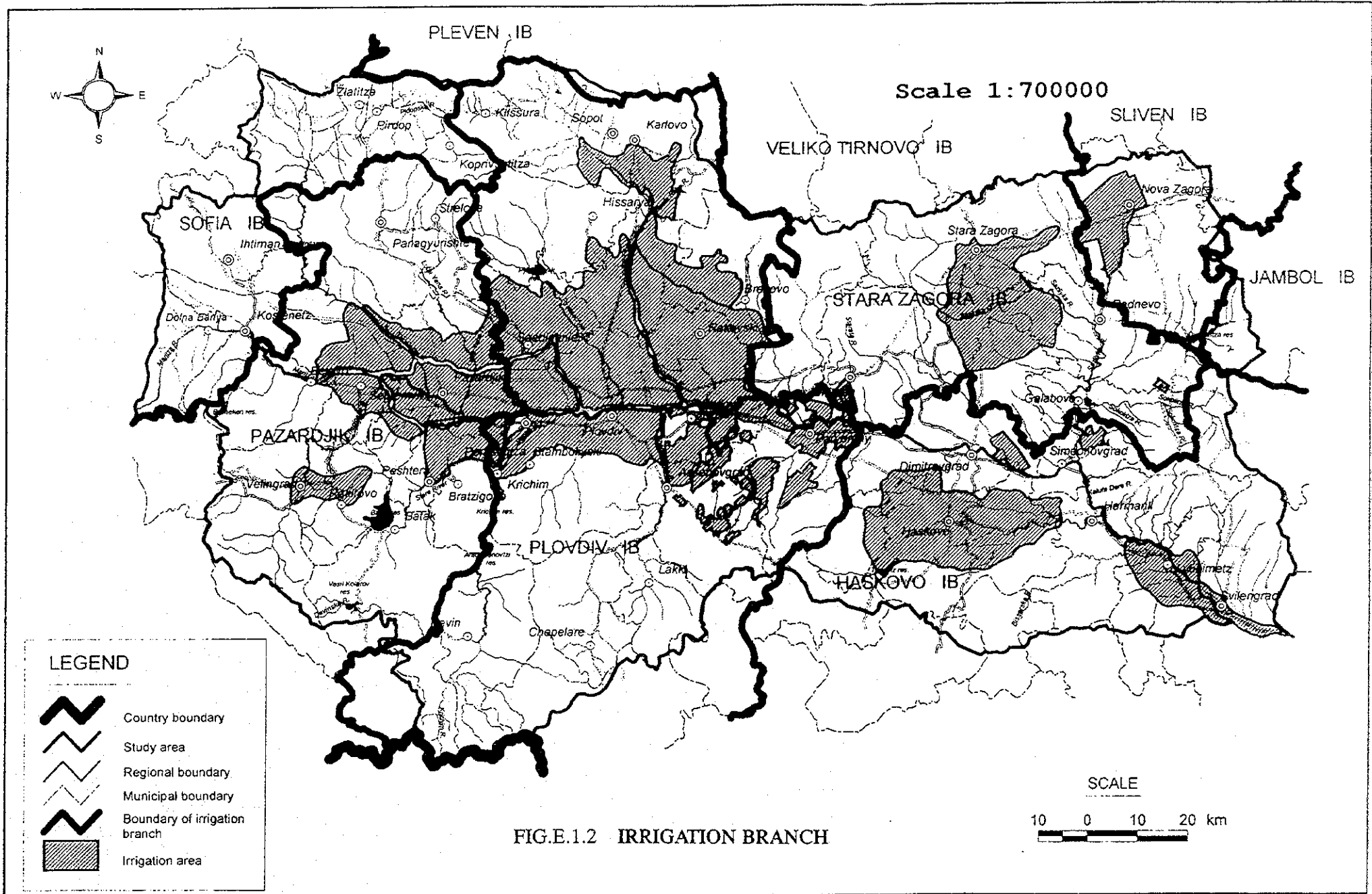


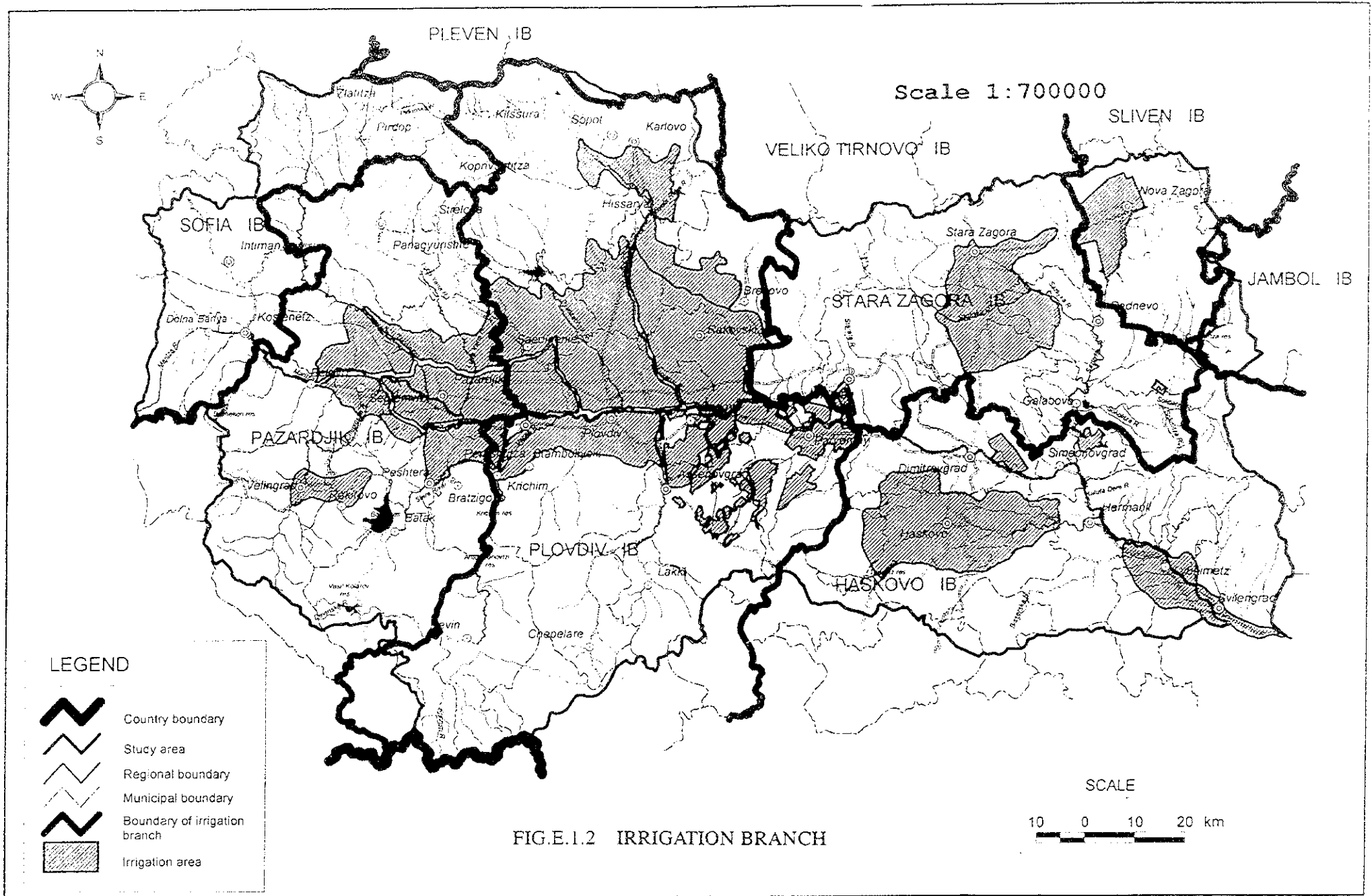
LEGEND

- Dams
- Hydropower plant (HPP)
- Thermal power plant (TPP)
- P.S. Pump station
- Waterway/Feeder canals
- Water transfer from other basin
- Irrigation area under operation
- Irrigation area not under operation
- Main canals
- Primary canals
- Major intake wear
- Scheme

FIG.E.1.1 MAJOR RESERVOIRS IRRIGATION SYSTEMS AND HYDROPOWER SCHEMES IN THE MARITZA RIVER BASIN







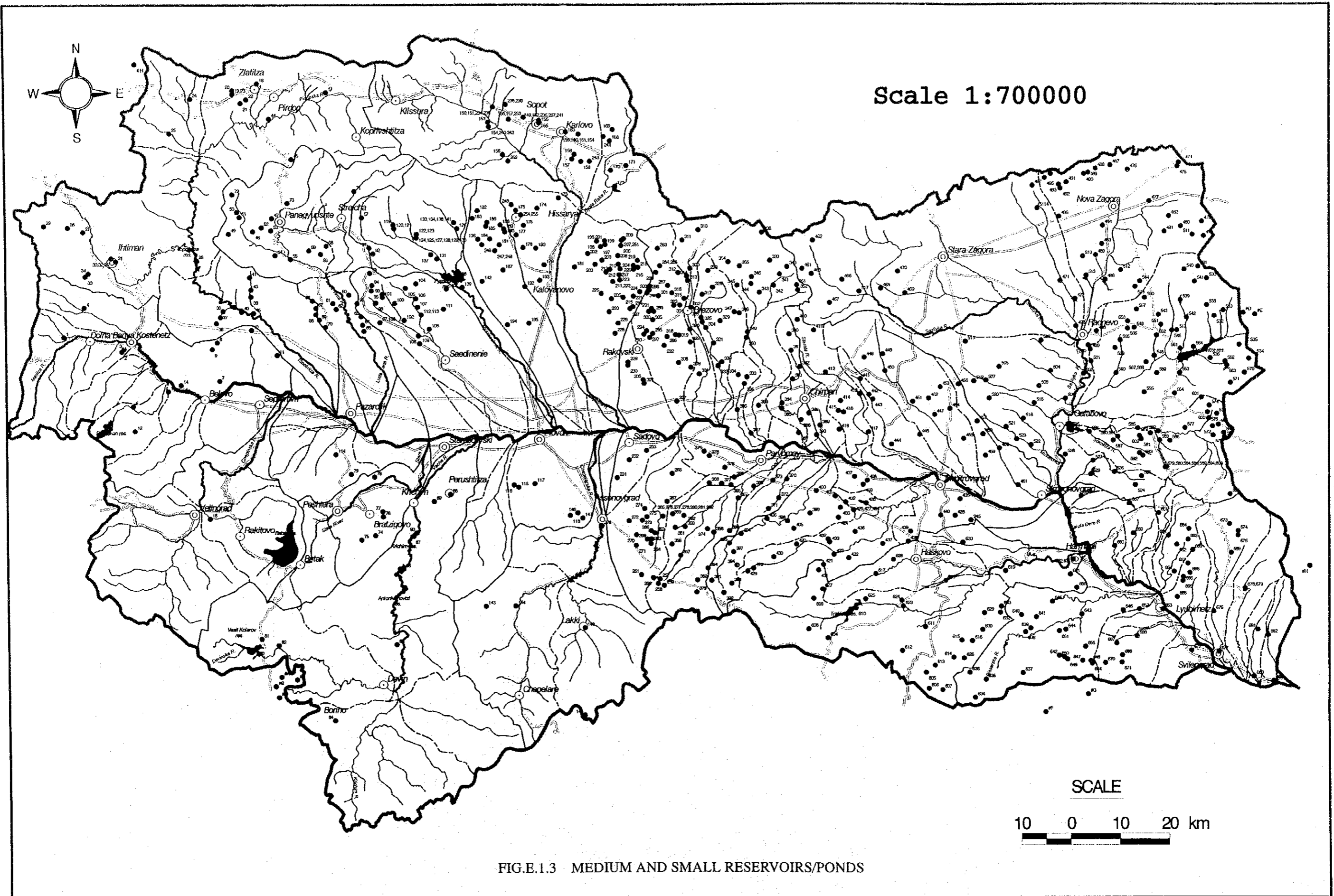
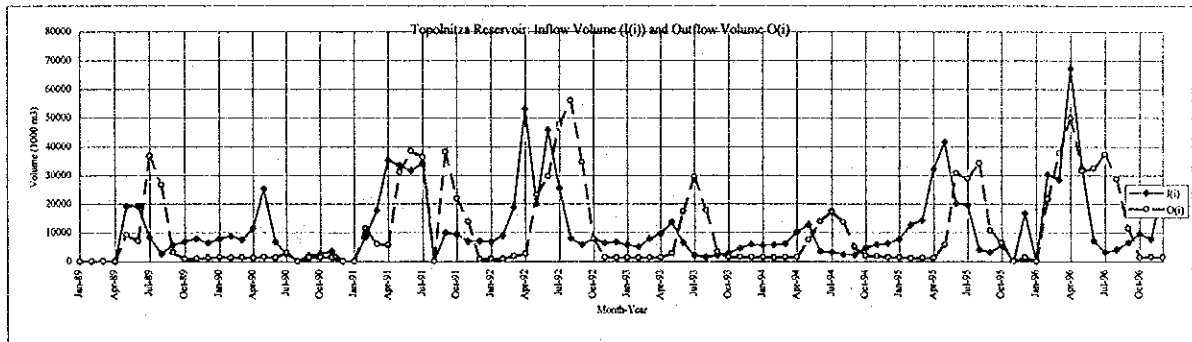
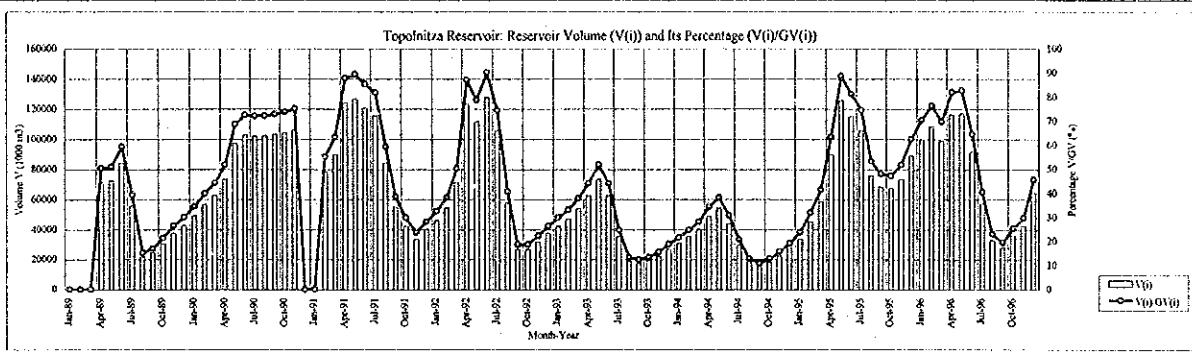
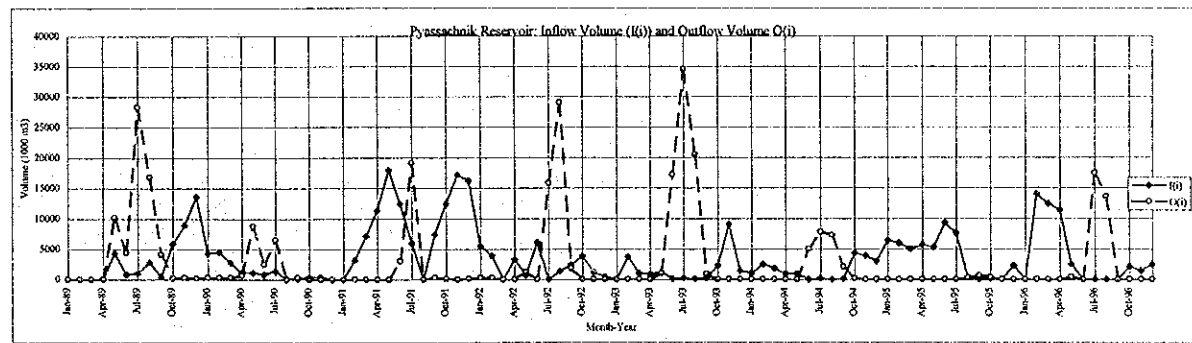
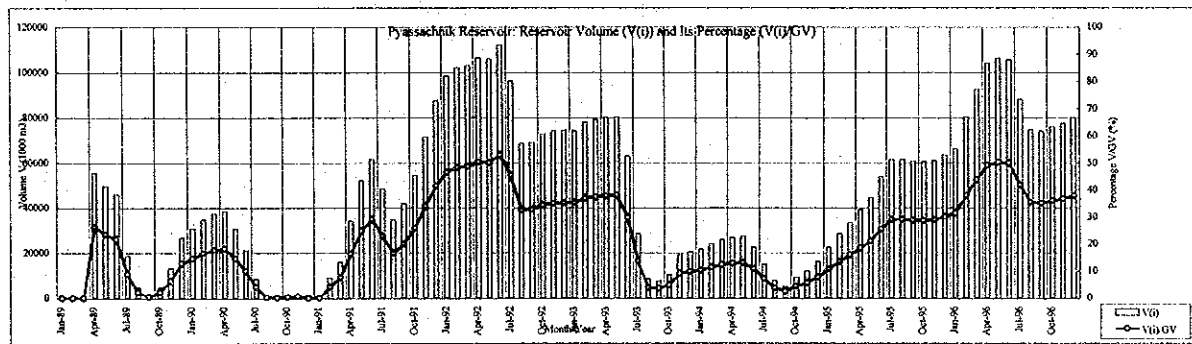


FIG.E.1.3 MEDIUM AND SMALL RESERVOIRS/PONDS

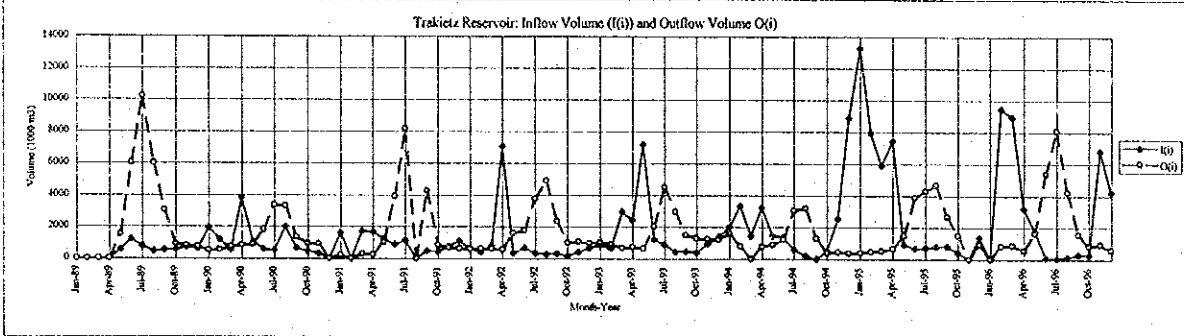
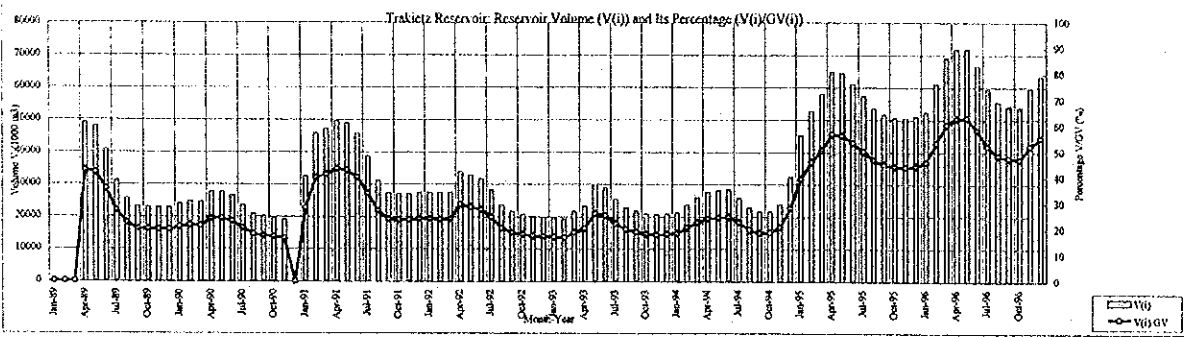


(1) TOPOLINTZA RESERVOIR

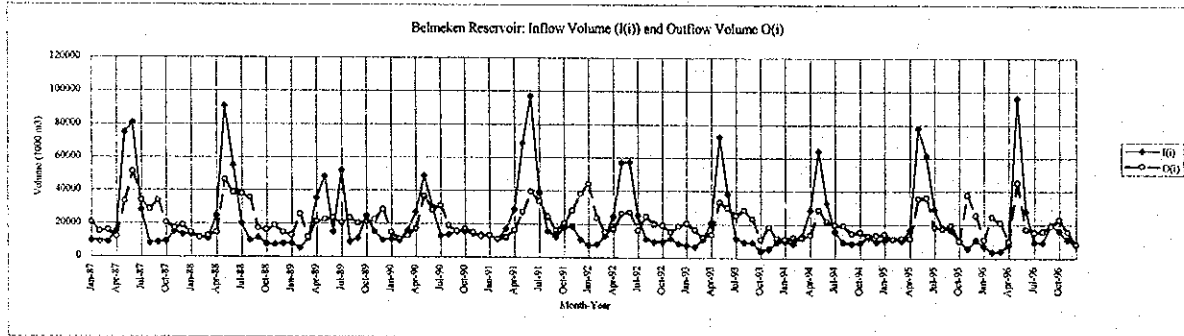
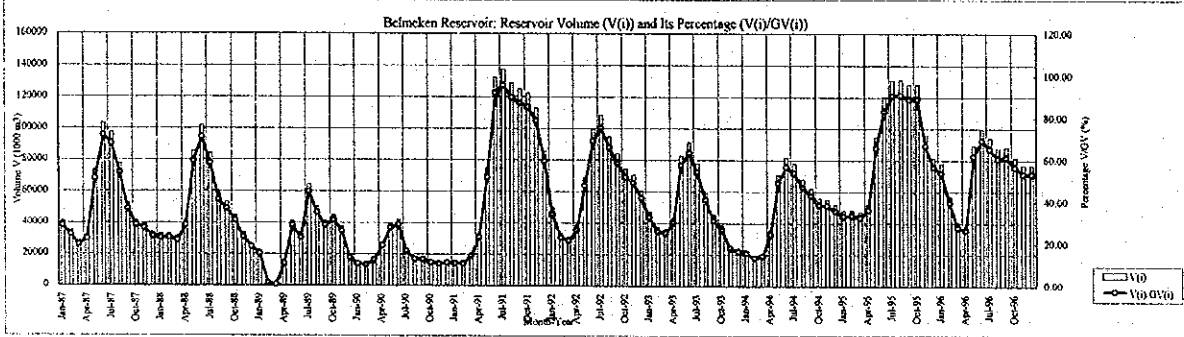


(2) PYASSACHNIK RESERVOIR

FIG. E.2.1 MONTHLY WATER BALANCE OF MAJOR RESERVOIR (1/3)

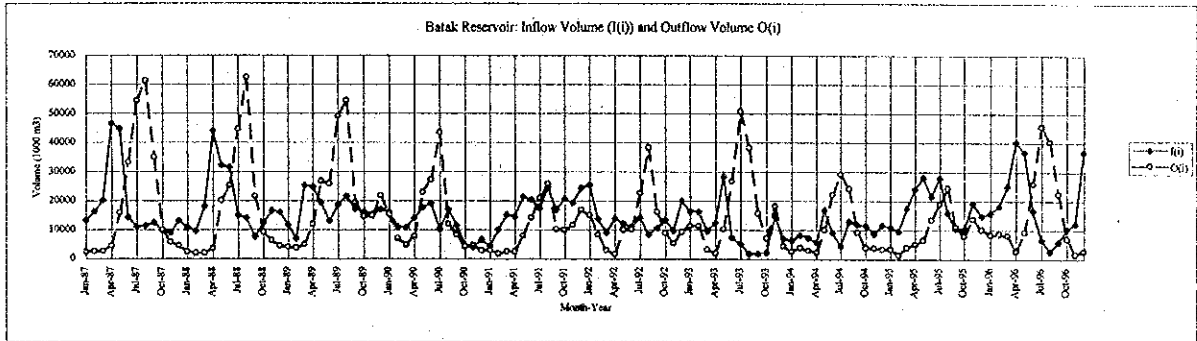
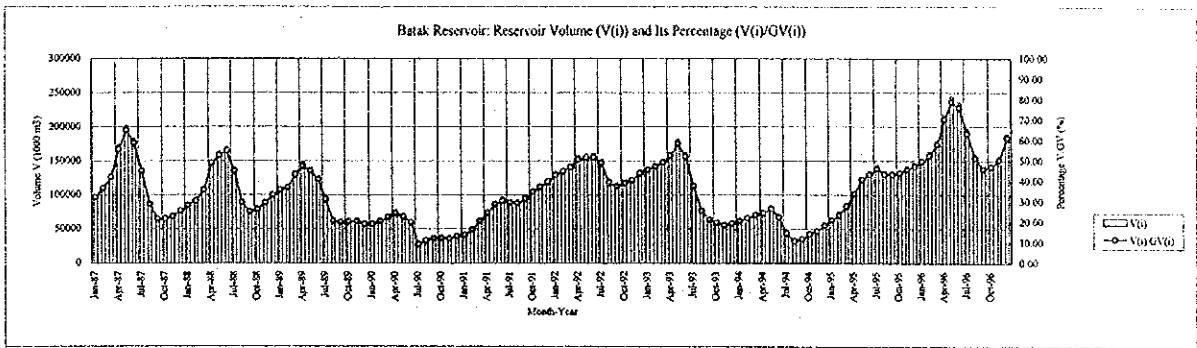


(3) TRAKIETZ RESERVOIR

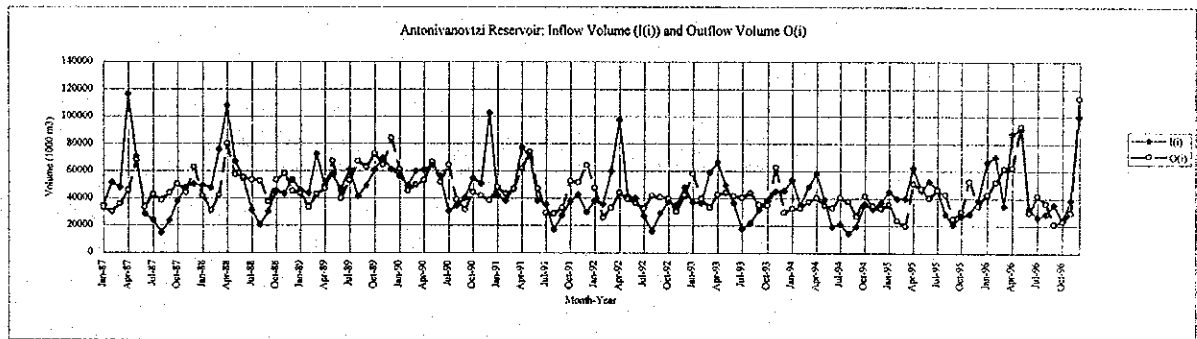
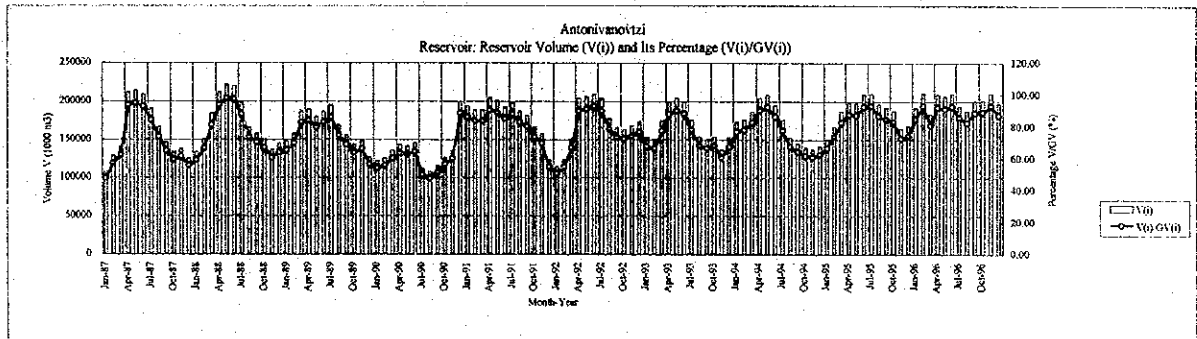


(4) BELMEKEN RESERVOIR

FIG. E.2.1 MONTHLY WATER BALANCE OF MAJOR RESERVOIR (2/3)

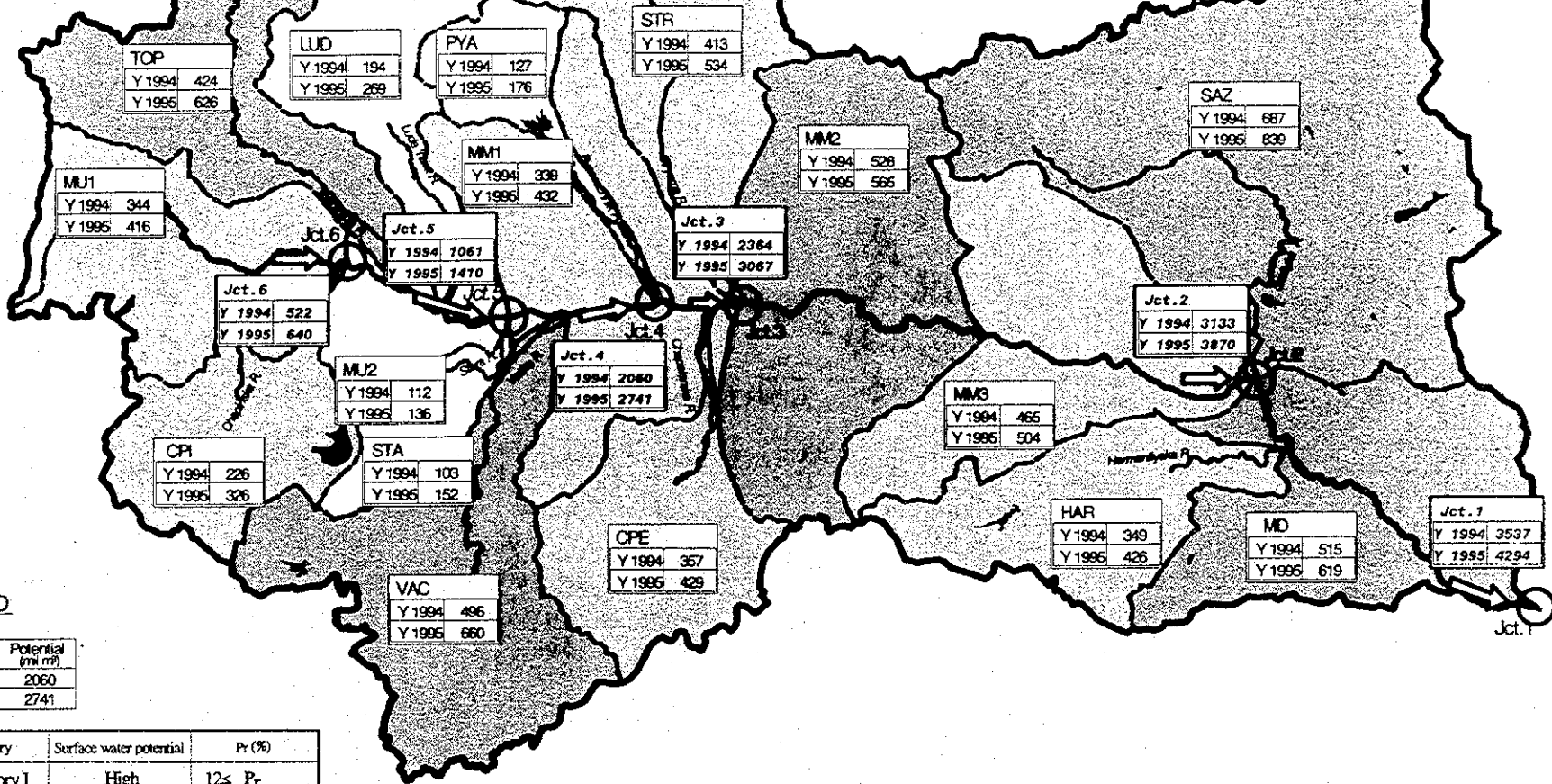
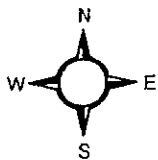


(5) BATAK RESERVOIR



(6) ANTONIVANOVTZI RESERVOIR

FIG. E.2.1 MONTHLY WATER BALANCE OF MAJOR RESERVOIR (3/3)



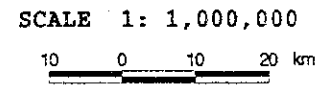
LEGEND

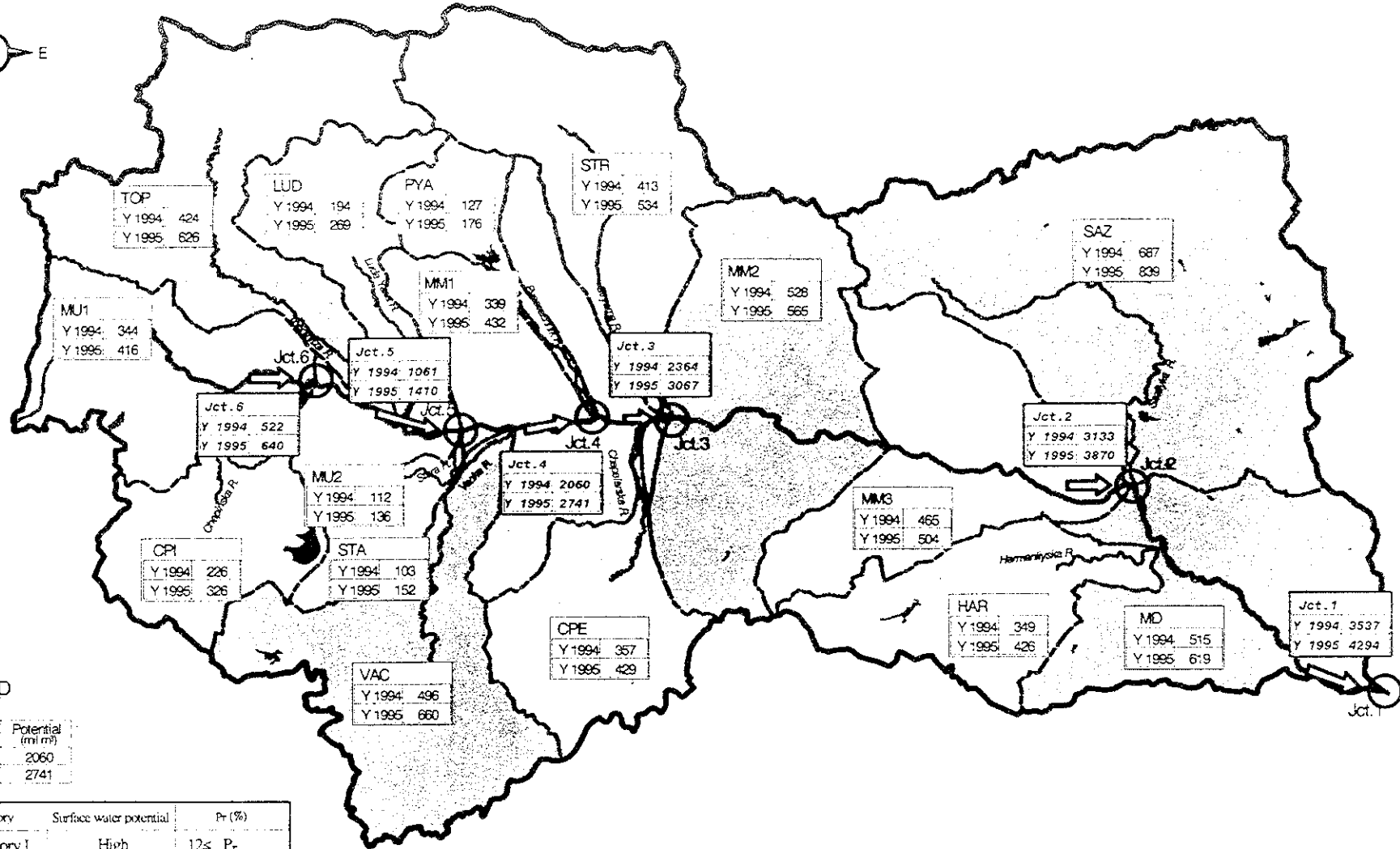
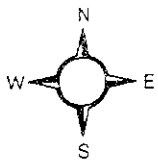
Year	Potential (m/m)
Y 1994	2060
Y 1995	2741

Category	Surface water potential	Pr (%)
Category I	High	$12 \leq P_r$
Category II	Medium	$6 \leq P_r < 12$
Category III	Low	$P_r < 6$

Note : Pr : (Natural surface water potential of each basin)
 //(Natural surface water potential at Jct.1)

FIG.E.4.1 NATURAL SURFACE WATER POTENTIAL IN 1994 AND 1995





LEGEND

Year	Potential (ml m)
Y 1994	2060
Y 1995	2741

Category	Surface water potential	Pr (%)
Category I	High	$12 \leq P_r$
Category II	Medium	$6 \leq P_r < 12$
Category III	Low	$P_r < 6$

Note : Pr : (Natural surface water potential of each basin)
 /(Natural surface water potential at Jct.1)

FIG.E.4.1 NATURAL SURFACE WATER POTENTIAL IN 1994 AND 1995

SCALE 1 : 1,000,000



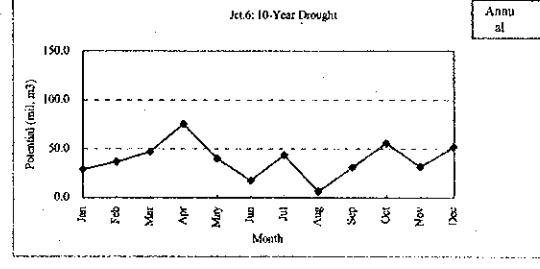
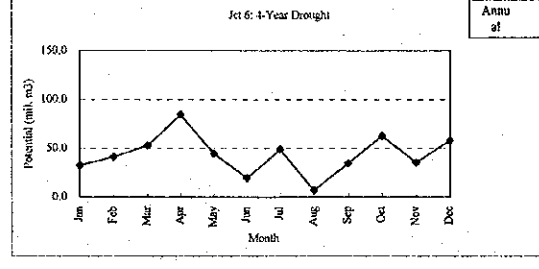
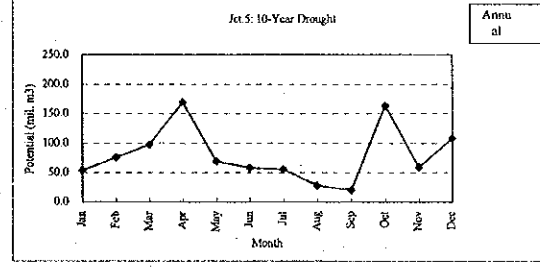
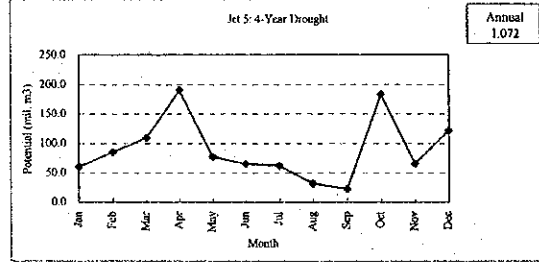
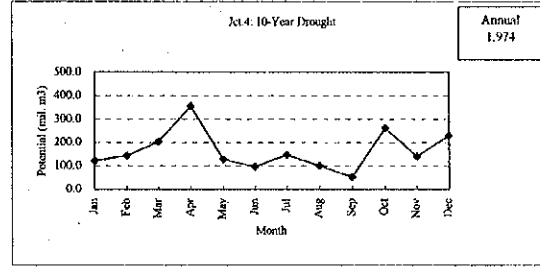
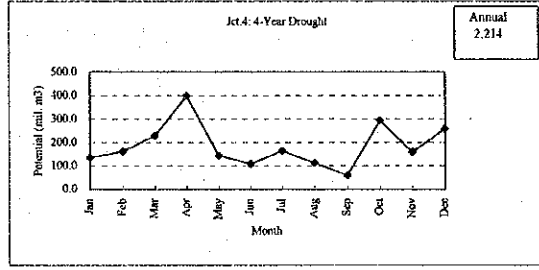
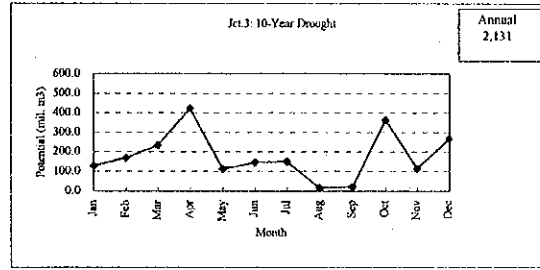
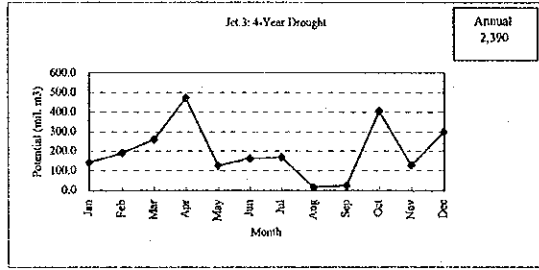
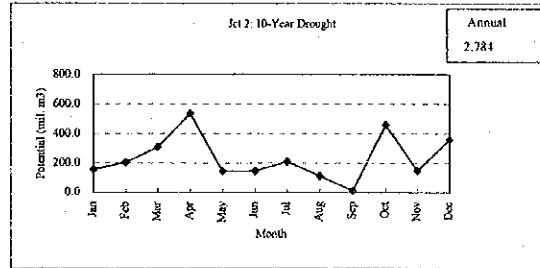
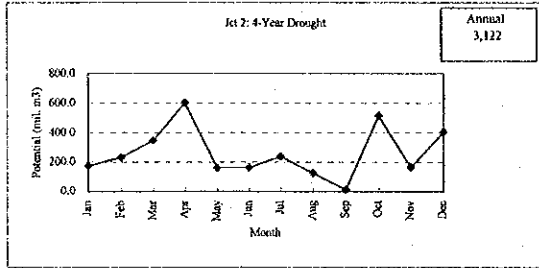
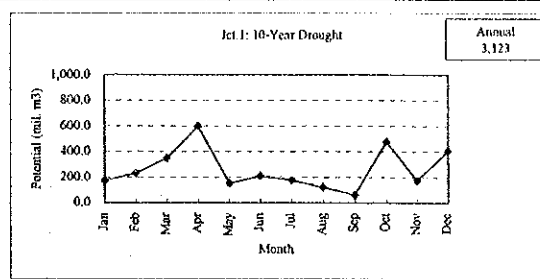
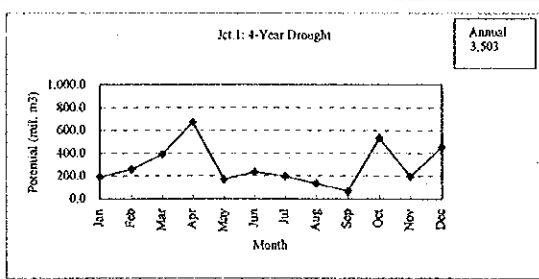


FIG. E.4.2 MONTHLY NATURAL RUNOFF POTENTIAL OF 4-YEAR DROUGHT AND 10-YAER DROUGHT

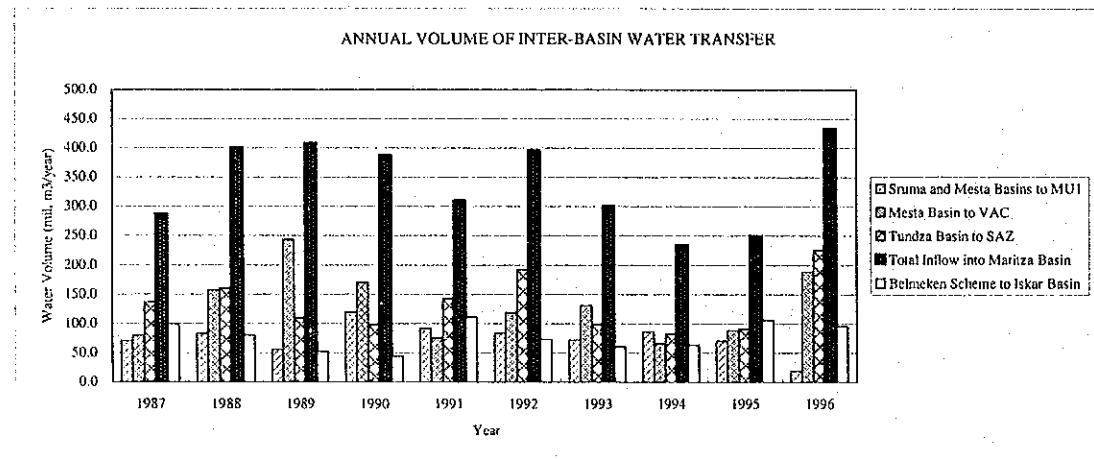
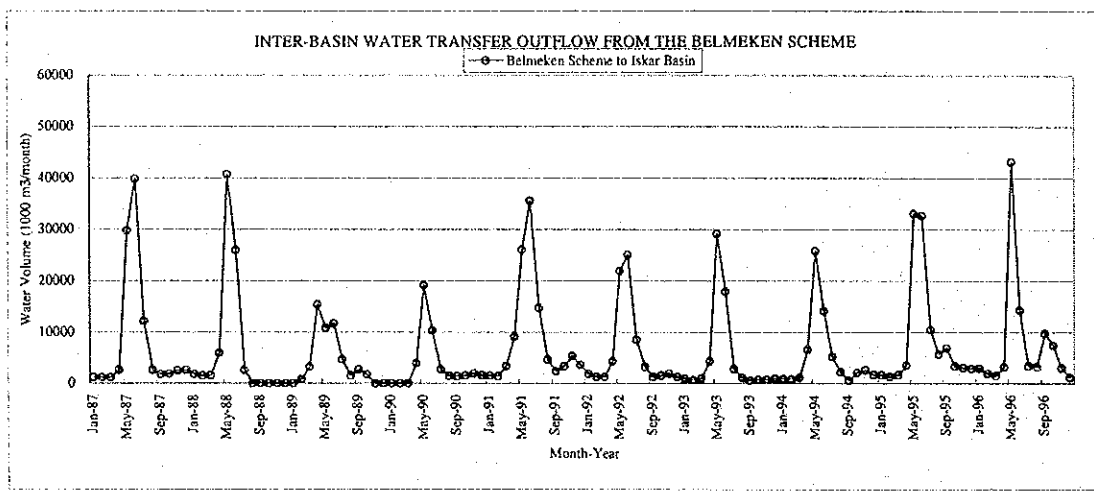
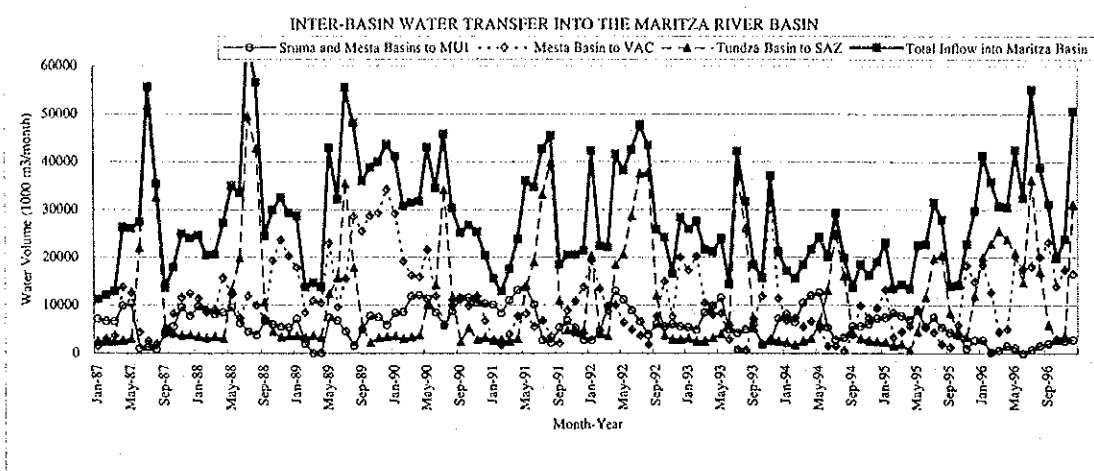
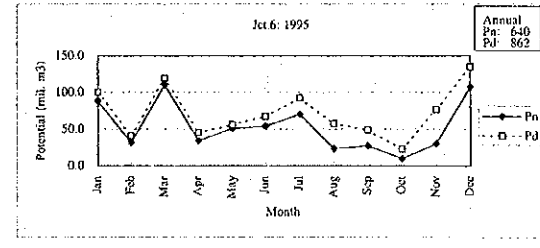
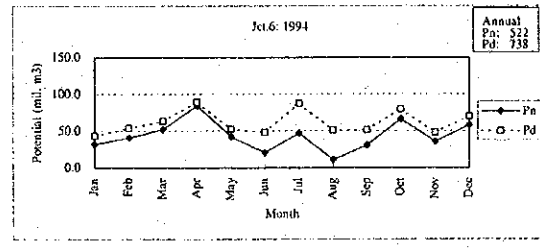
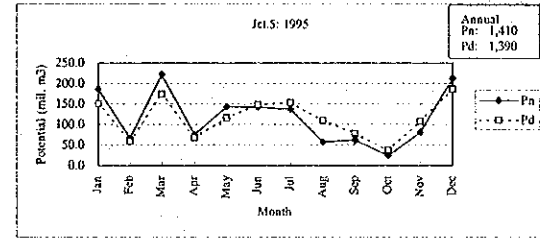
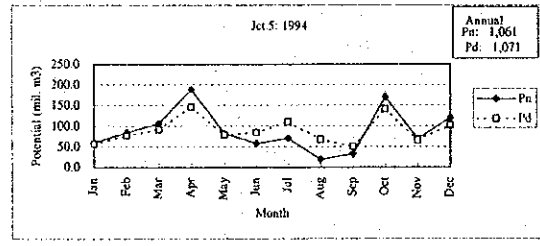
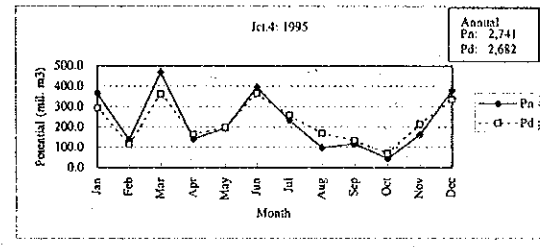
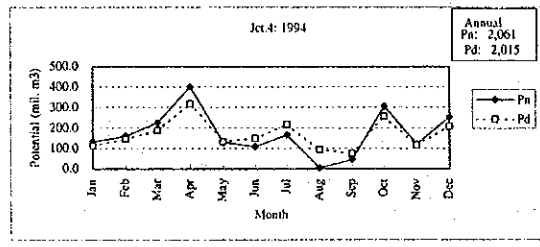
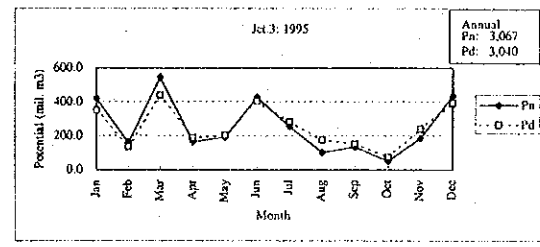
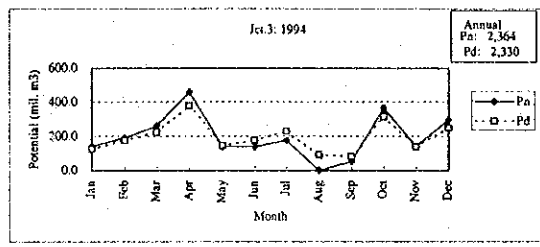
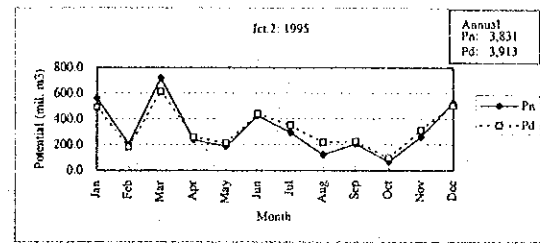
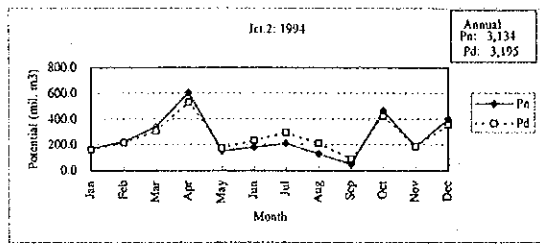
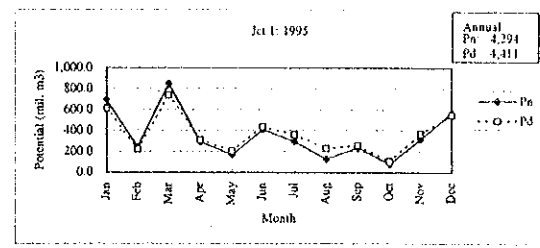
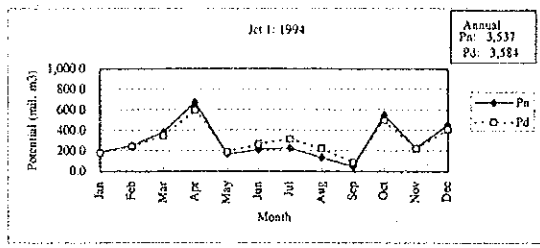
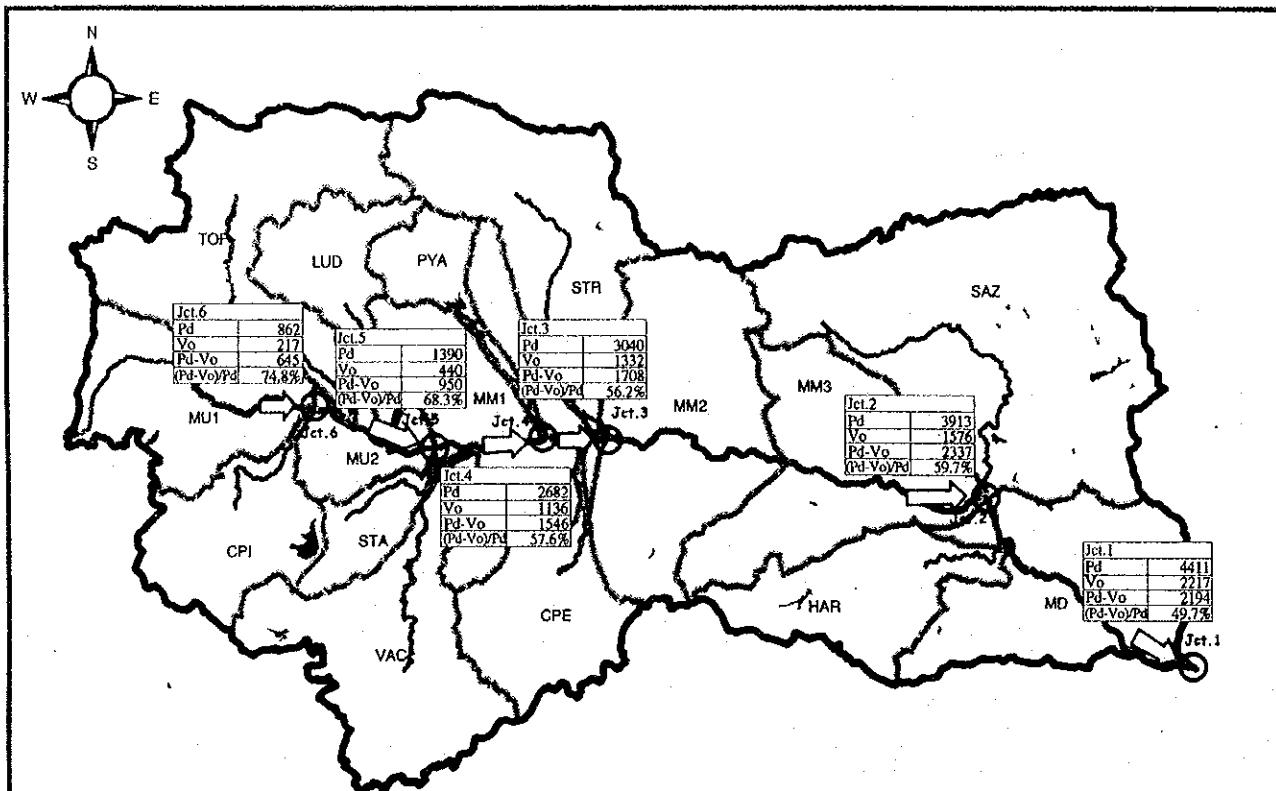


FIG. E.4.3 INTER-BASIN WATER TRANSFER VOLUME

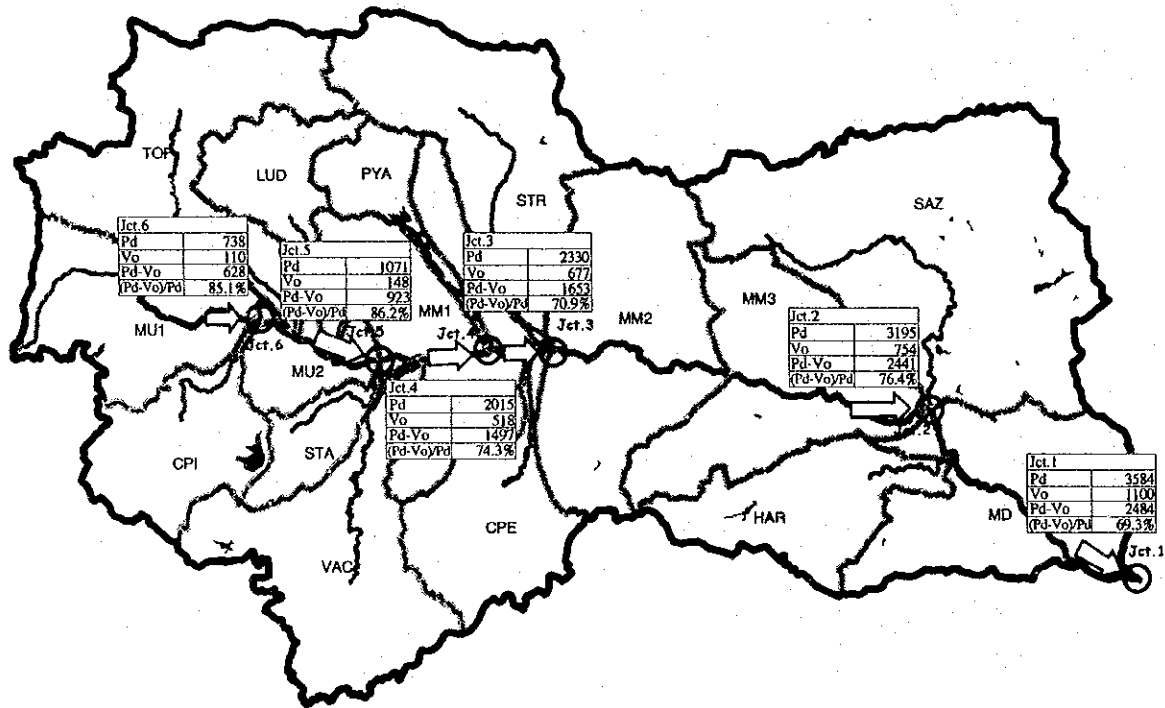


Pn : Natural runoff potential Pd : Runoff potential with major dams

FIG. E.4.4 COMPARISON OF MONTHLY NATURAL RUNOFF POTENTIAL WITH DISTURBED POTENTIAL WITH MAJOR DAMS IN 1994 AND 1995



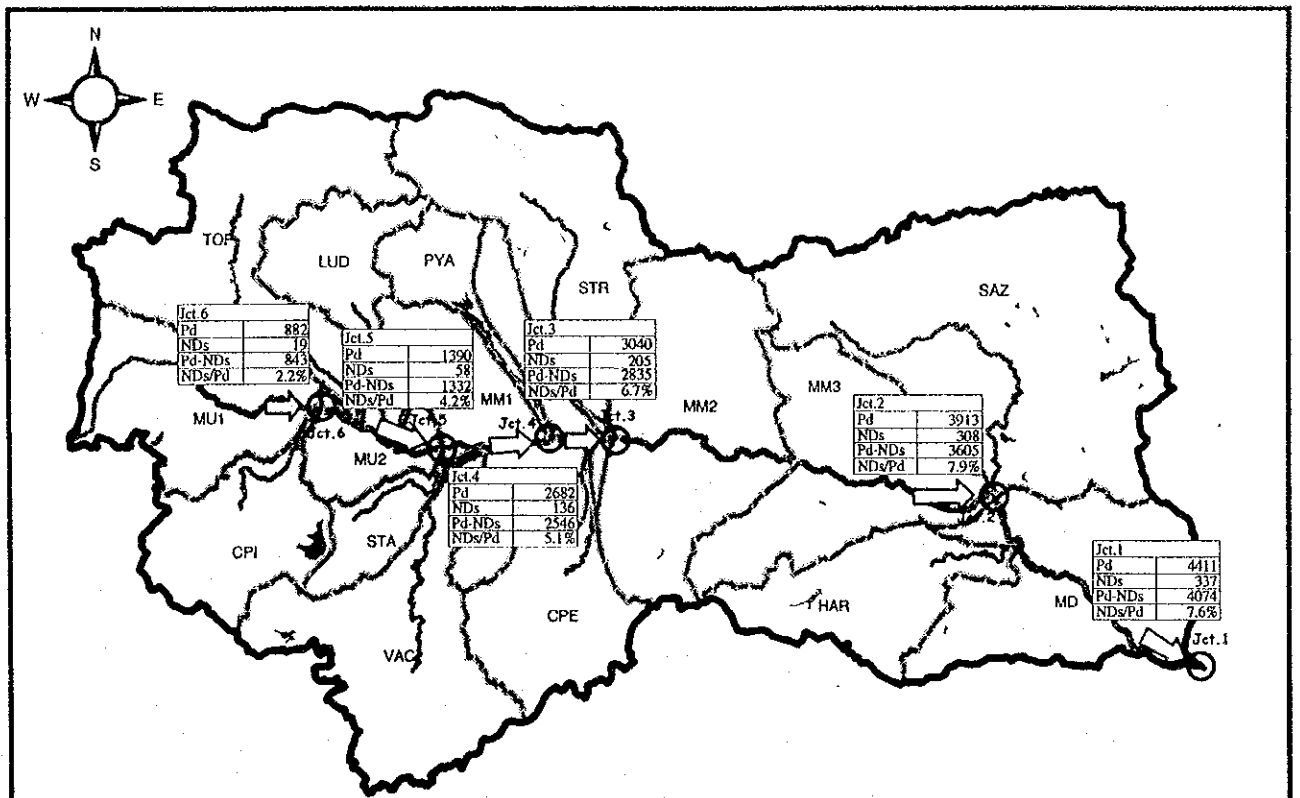
ANNUAL BALANCE IN 1995 (AVERAGE YEAR)



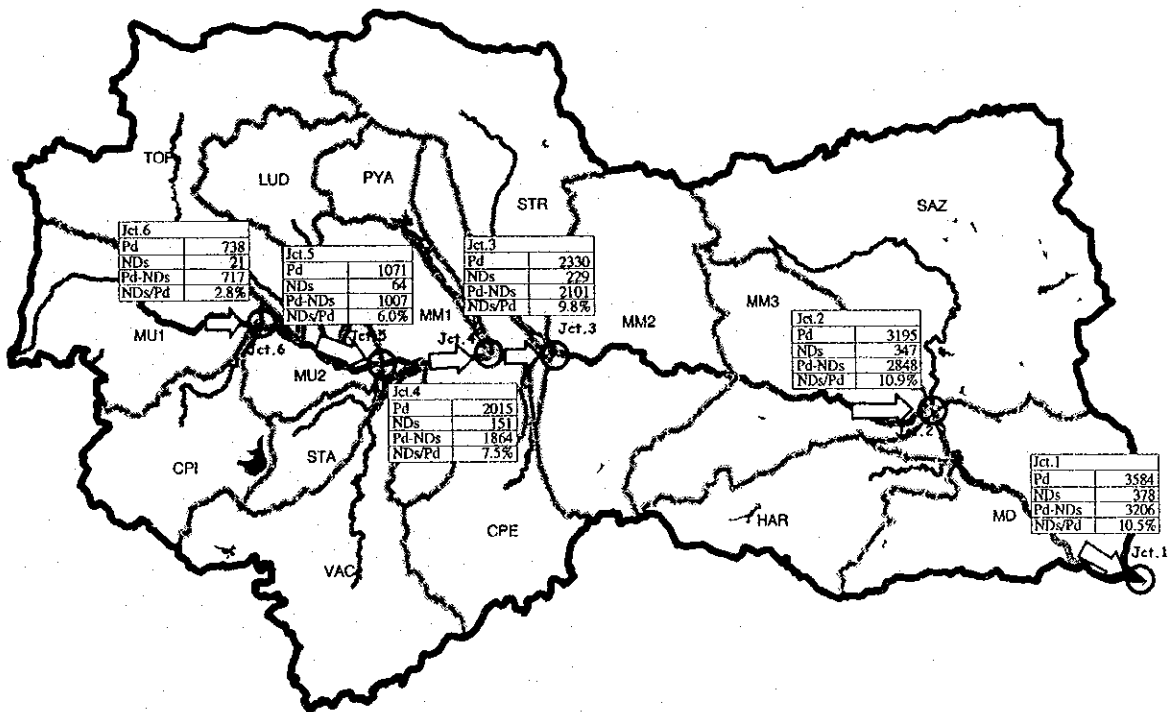
ANNUAL BALANCE IN 1994 (4-YEAR DROUGHT)

Pd : Surface water potential with major dams (mil.m³/year)
 Vo : Observed discharge volume (mil.m³/year)
 Pd-Vo/Pd : utilization rate of surface water (%)

FIG.E.5.1 PRESENT SURFACE WATER BALANCE BASED ON THE OBSERVED DISCHARGE



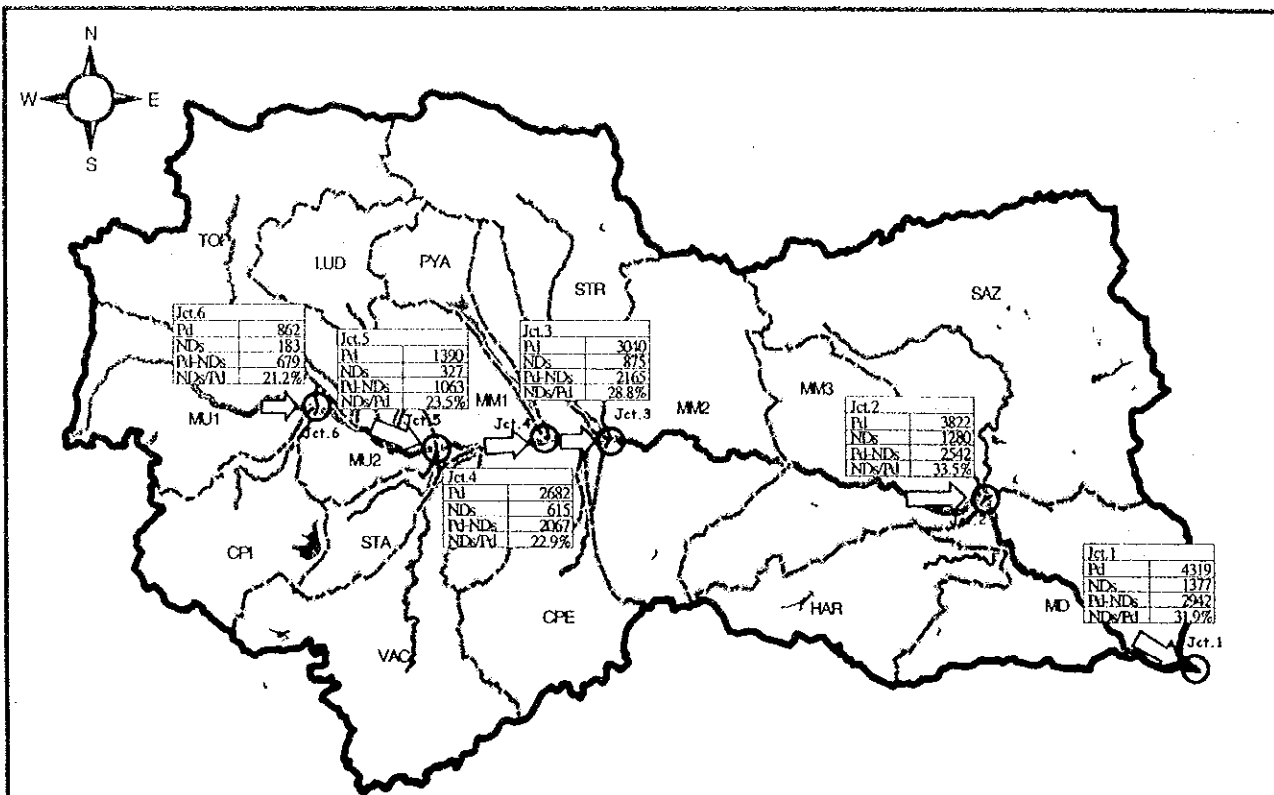
ANNUAL BALANCE IN 1995 (AVERAGE YEAR)



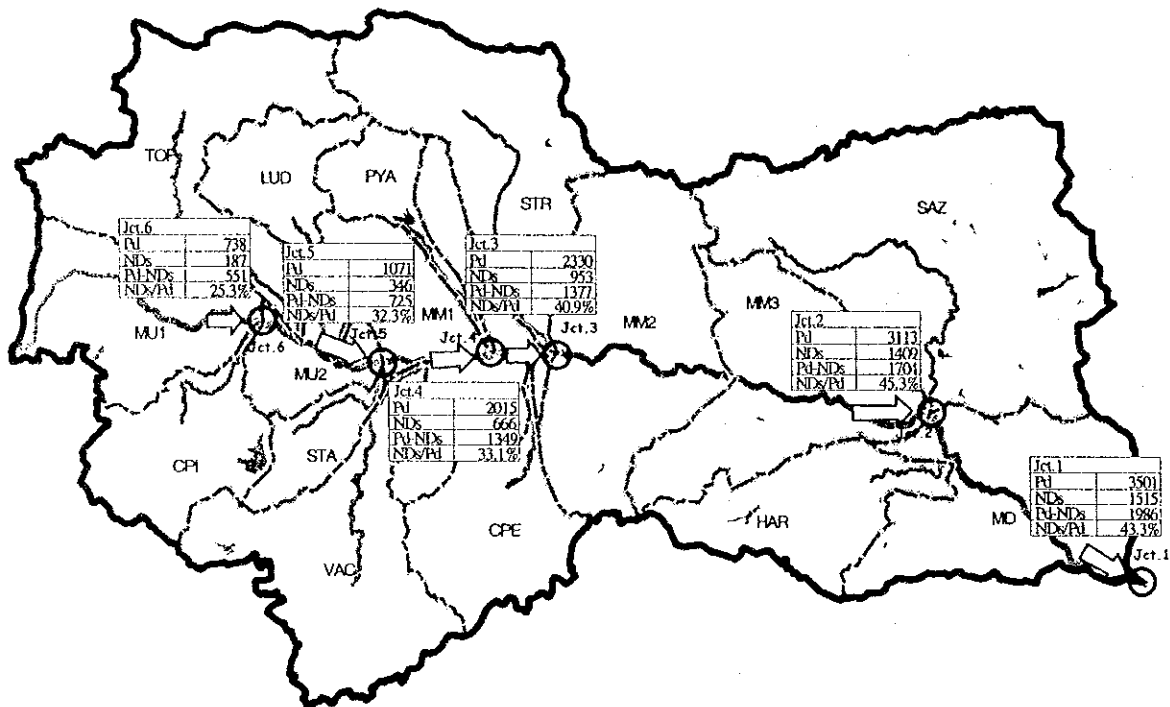
ANNUAL BALANCE IN 1994 (4-YEAR DROUGHT)

Pd : Surface water potential with major dams (mil.m³/year)
 NDs : Net water demand composed of irrigation ,domestic WS,industrial WS
 and animal breeding (mil.m³/year)
 NDs/Pd : water utilization rate (%)

FIG.E.5.2 POSSIBLE SURFACE WATER BALANCE IN THE PRESENT
 BASED ON THE ESTIMATED WATER DEMAND



ANNUAL BALANCE IN AVERAGE YEAR (LEVEL OF YEAR 1995)



ANNUAL BALANCE IN 4-YEAR DROUGHT (LEVEL OF YEAR 1994)

Pd : Surface water potential with major dams (ml.m³/year)
 NDS : Net water demand composed of irrigation ,domestic WS, industrial WS
 and animal breeding (ml.m³/year)
 NDS/Pd : water utilization rate (%)

Note
 CASE1 : Utilization rate of the state irrigation system
 with about 50 (%)

FIG.E.6.1 POSSIBLE SURFACE WATER BALANCE IN 2015 (CASE1)
 BASED ON THE ESTIMATED WATER DEMAND

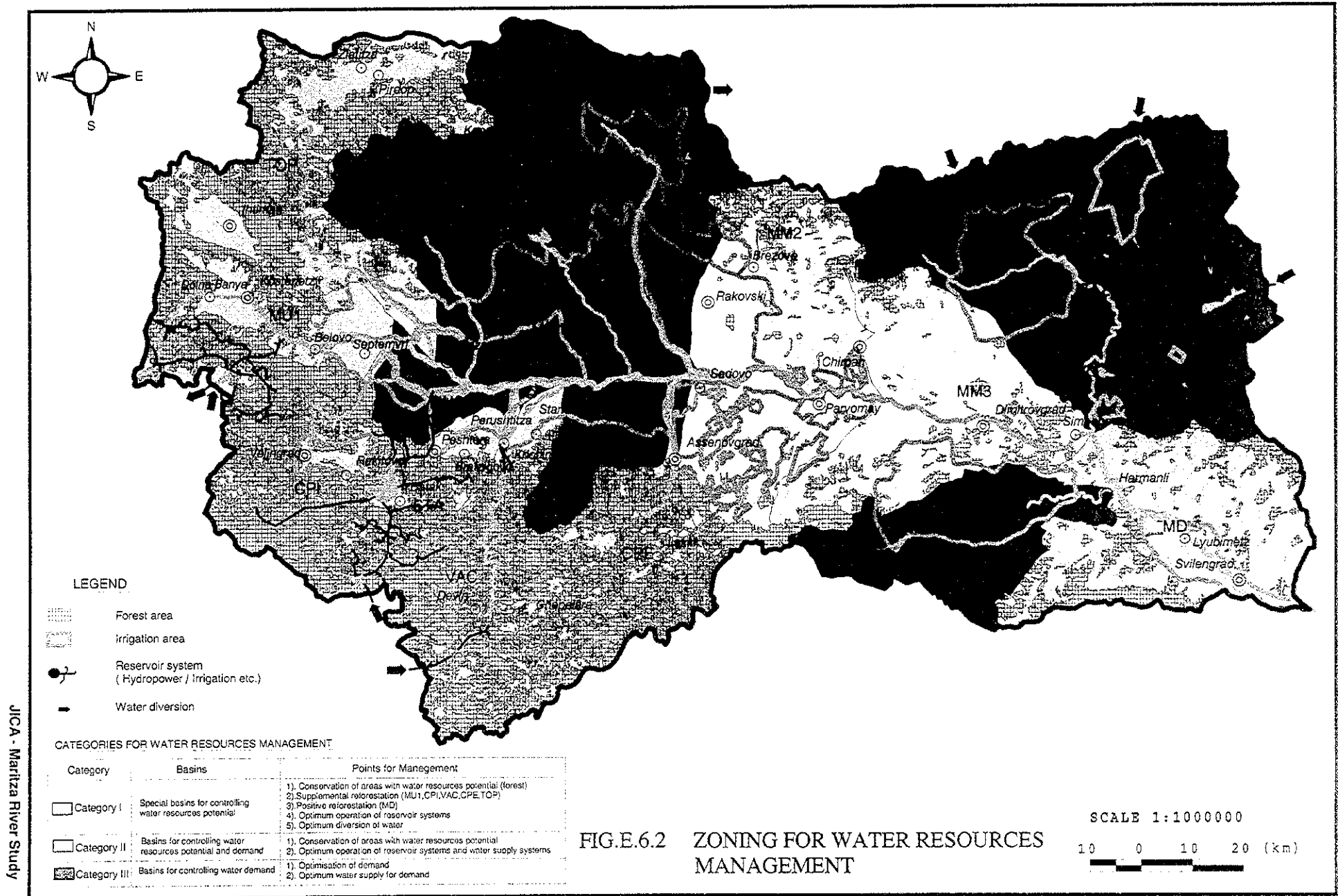
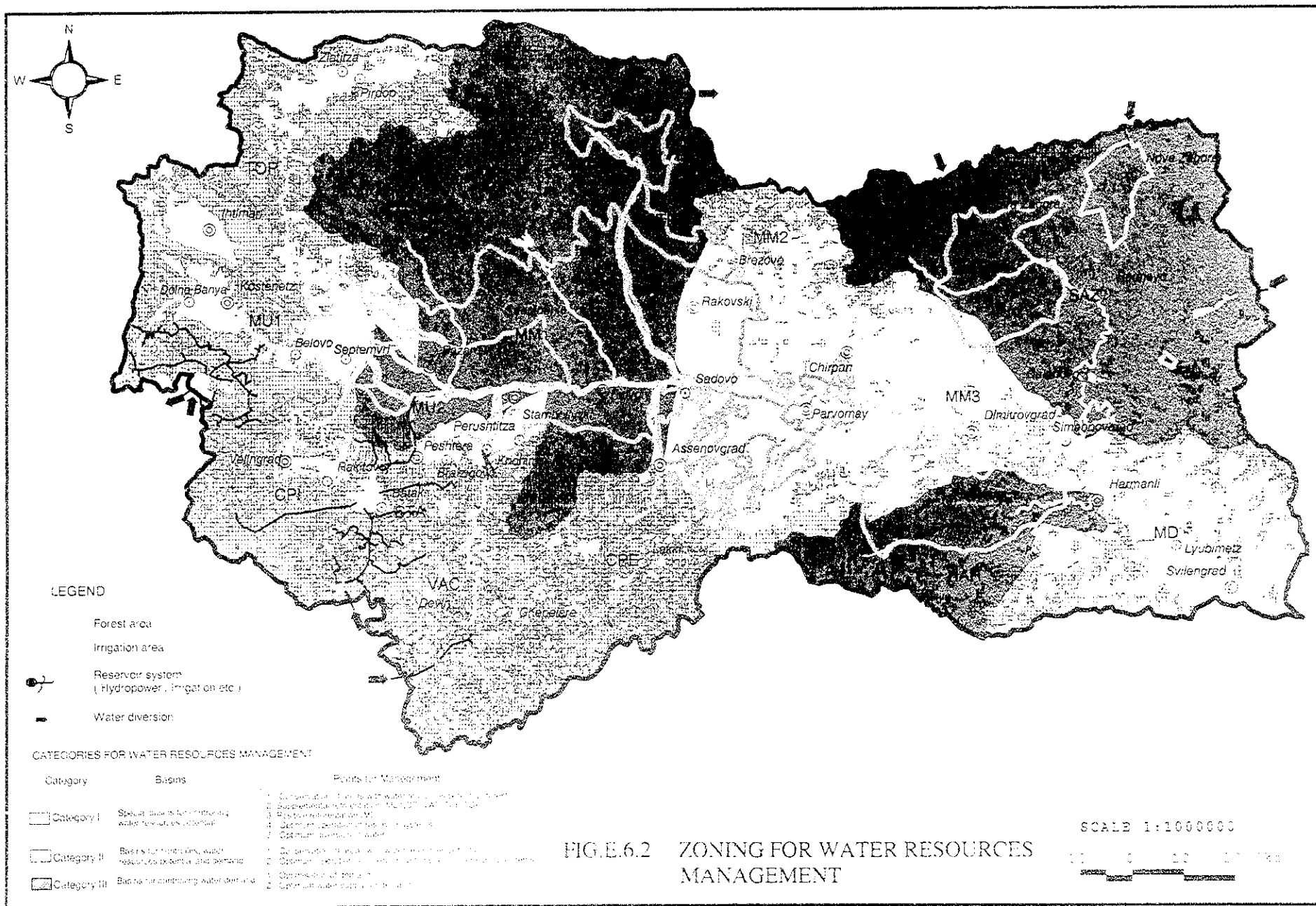
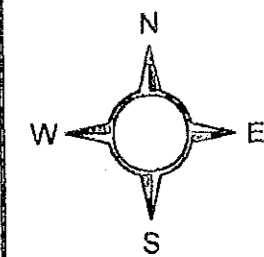


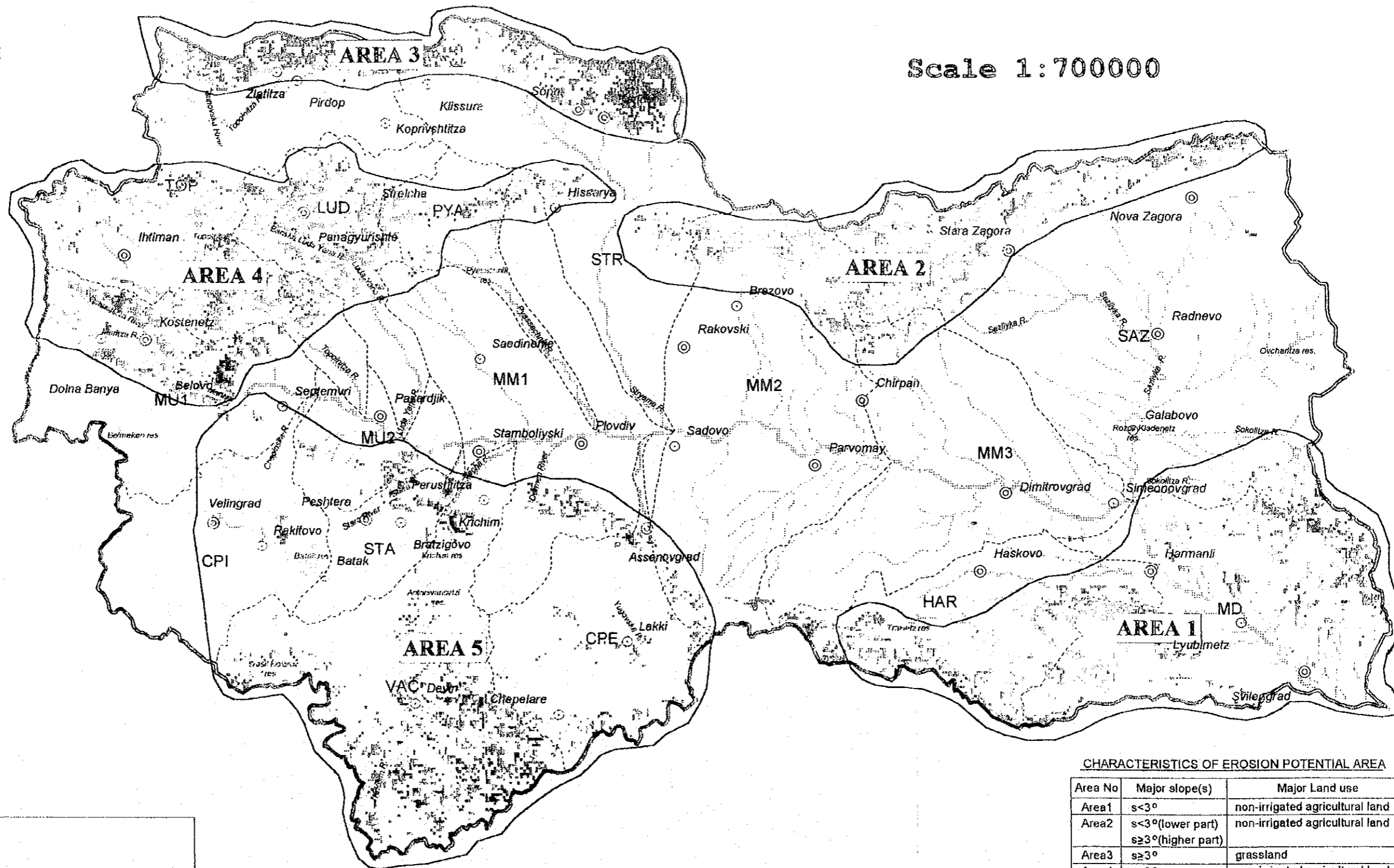
FIG.E.6.2 ZONING FOR WATER RESOURCES MANAGEMENT







Scale 1:700000



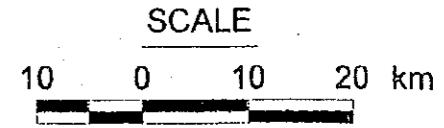
LEGEND

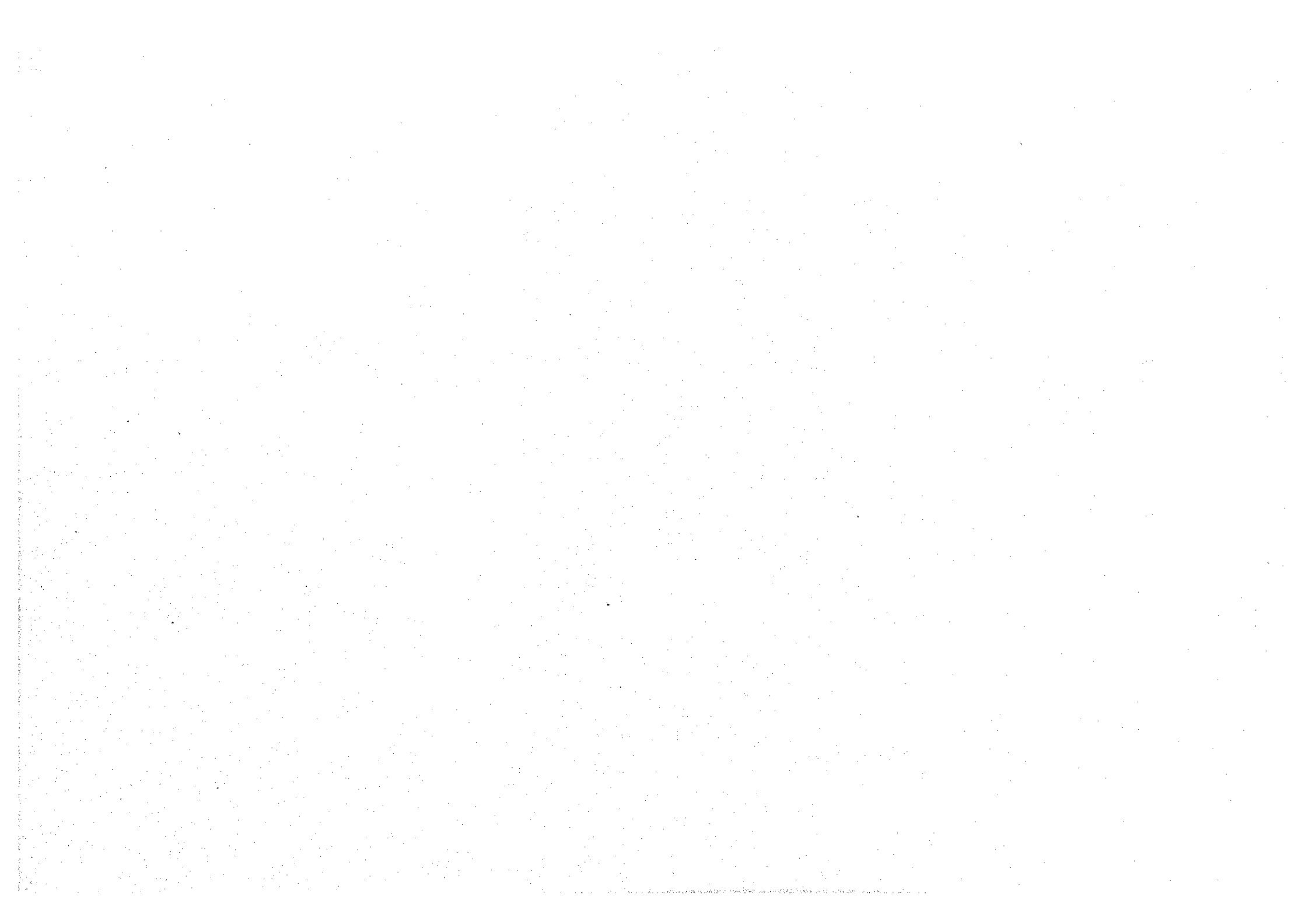
- (A) Slope > 3°
- (B) Erosion potential + Grassland
- (C) Erosion potential + Non-irrigated agricultural land
- (D) Erosion potential + Bare land
- Overlap (A) and (B)
- Overlap (A) and (C)
- Overlap (A) and (D)

CHARACTERISTICS OF EROSION POTENTIAL AREA

Area No	Major slope(s)	Major Land use
Area1	s < 3°	non-irrigated agricultural land
Area2	s < 3° (lower part) s ≥ 3° (higher part)	non-irrigated agricultural land
Area3	s ≥ 3°	grassland
Area4	s ≥ 3°	non-irrigated agricultural land
Area5	s ≥ 3°	non-irrigated agricultural land and grassland

FIG.E.6.3 ANALYSIS OF EROSION POTENTIAL AND PROTECTION AREA TO BE CONSIDERED





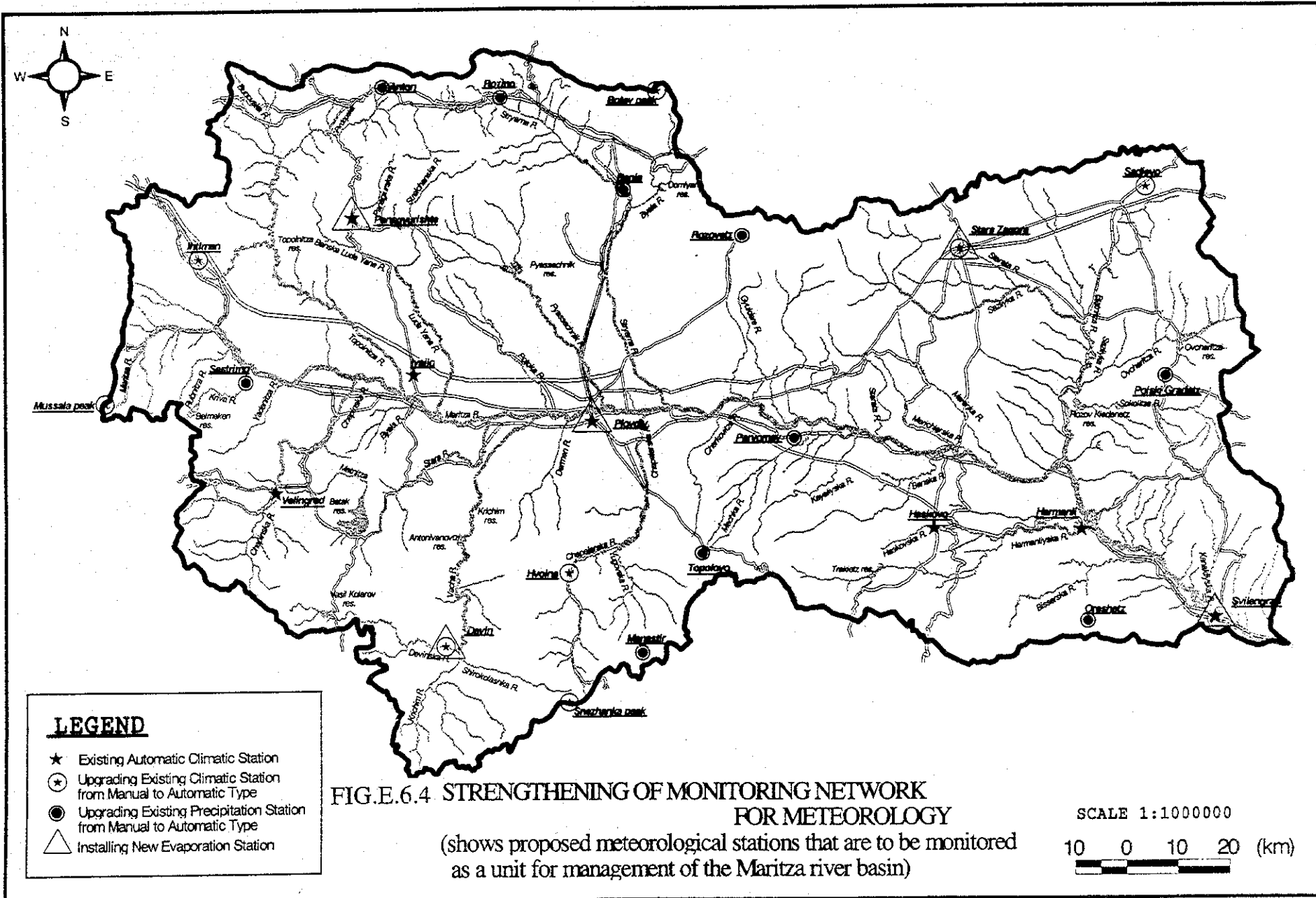


FIG.E.6.4 STRENGTHENING OF MONITORING NETWORK FOR METEOROLOGY
 (shows proposed meteorological stations that are to be monitored as a unit for management of the Maritza river basin)

SCALE 1:1000000
 10 0 10 20 (km)

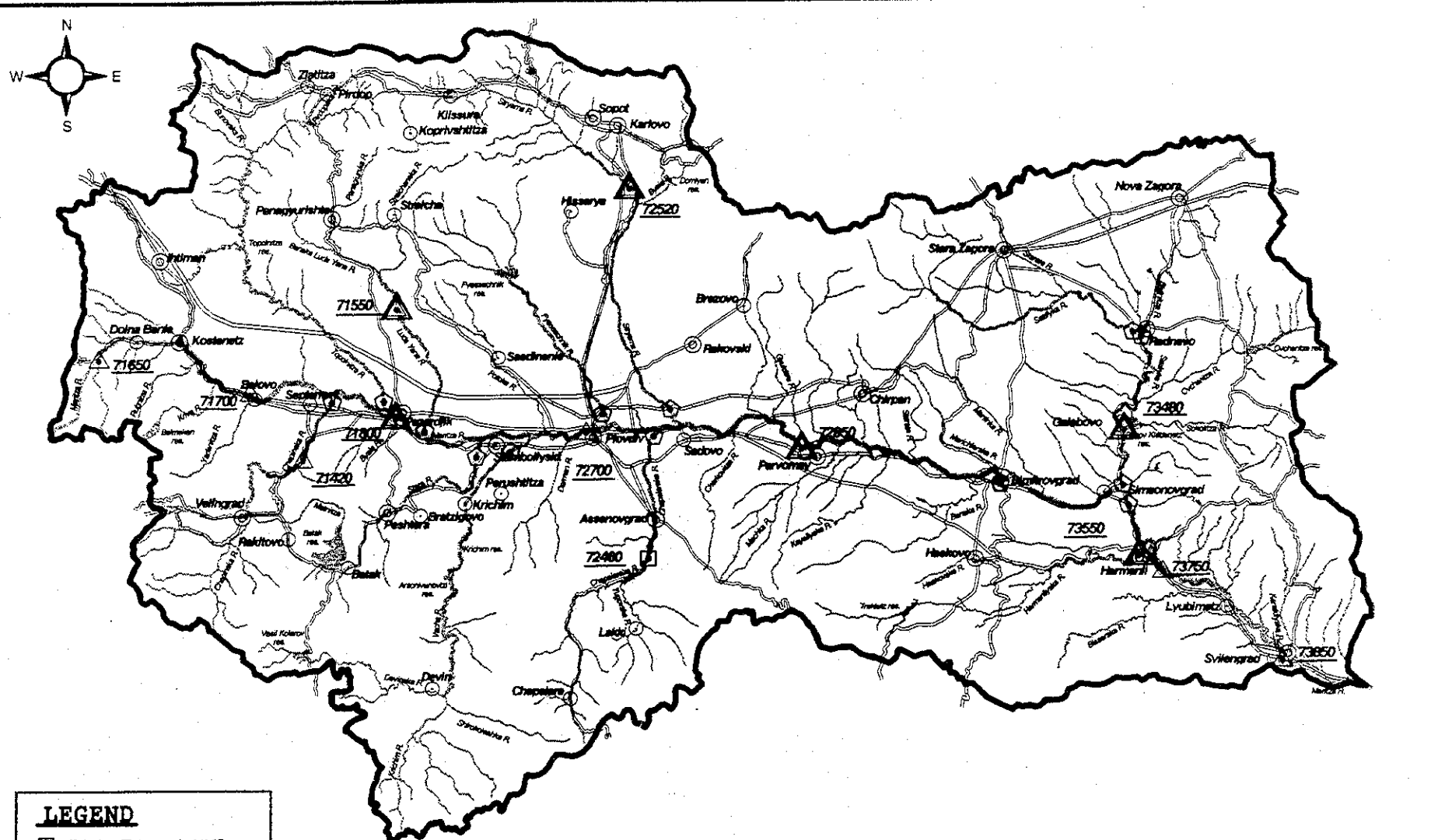
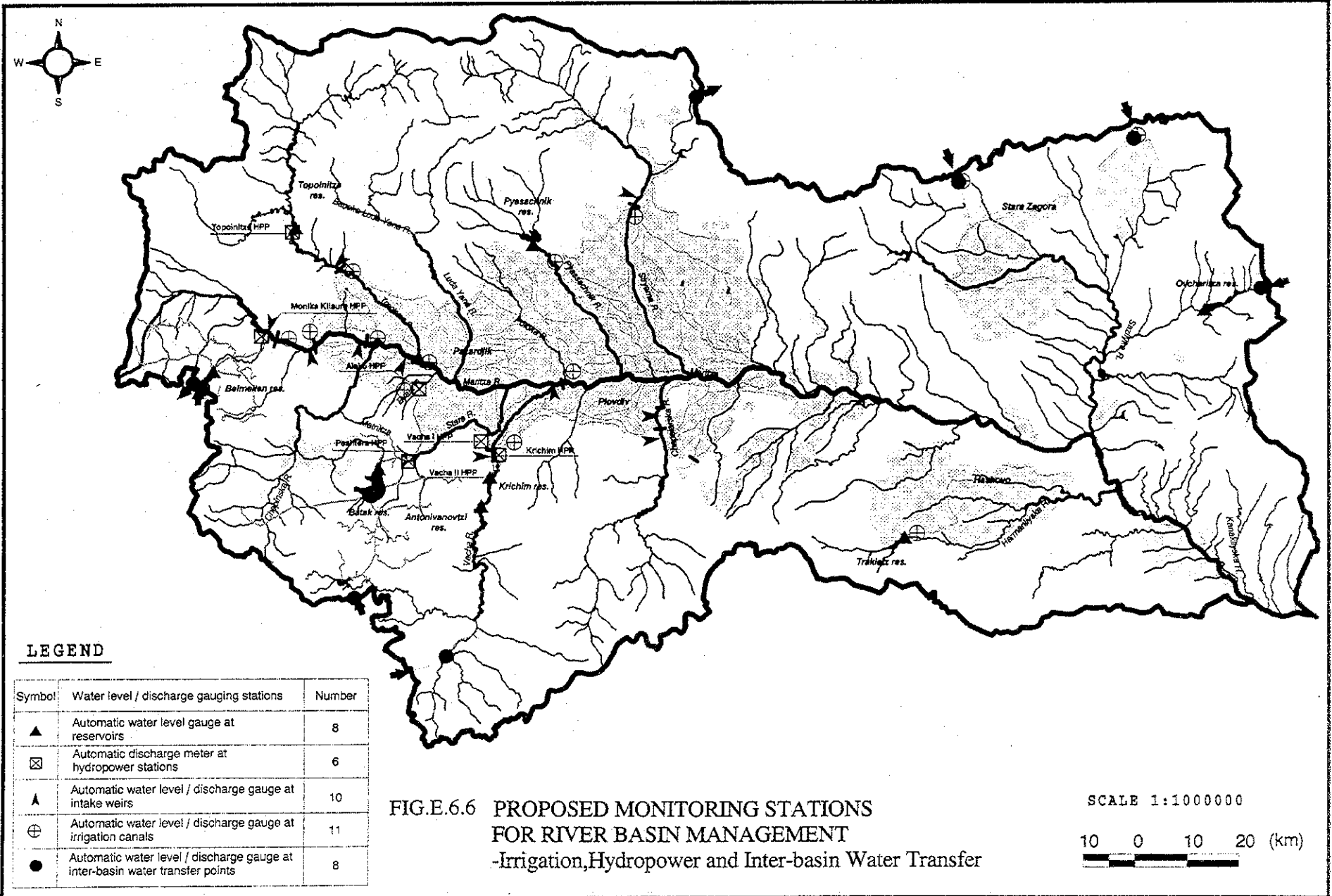


FIG.E.6.5 STRENGTHENING OF MONITORING NETWORK FOR HYDROLOGY
 (shows proposed hydrometric stations that are to be monitored as a unit for management of the Maritza river basin)

SCALE 1:1000000
 10 0 10 20 (km)

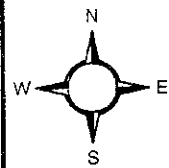


LEGEND

Symbol	Water level / discharge gauging stations	Number
▲	Automatic water level gauge at reservoirs	8
⊠	Automatic discharge meter at hydropower stations	6
▲	Automatic water level / discharge gauge at intake weirs	10
⊕	Automatic water level / discharge gauge at irrigation canals	11
●	Automatic water level / discharge gauge at inter-basin water transfer points	8

FIG.E.6.6 PROPOSED MONITORING STATIONS FOR RIVER BASIN MANAGEMENT -Irrigation,Hydropower and Inter-basin Water Transfer

SCALE 1:1000000
 10 0 10 20 (km)



LEGEND

14.6 Percentage of present forest area of sub-basin

Class	Priority for Forest Conservation/Reforestation for water resources
Class 1	1). High priority of forest conservation 2). Supplemental reforestation for water resources
Class 2	1). Medium priority of forest conservation and reforestation for water resources
Class 3	1). High priority of forest conservation and reforestation (including agro-forestry and fruit trees) for water resources

FIG E.6.7 AREAS FOR FOREST CONSERVATION AND REFORESTATION FOR WATER RESOURCES

SCALE 1:1000000

