

KINGDOM OF THAILAND

**FEASIBILITY STUDY
ON
SEBAI-SEBOK BASIN DEVELOPMENT PROJECT**

**VOLUME 3
DRAWINGS**



FEBRUARY 1990

JAPAN INTERNATIONAL COOPERATION AGENCY

AFT
XXXXXXXXXX
89-71

国際協力事業団

20567

KINGDOM OF THAILAND

FEASIBILITY STUDY

ON

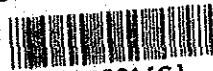
**SEBAI-SEBOK BASIN DEVELOPMENT
PROJECT**

IN

THE NORTHEAST REGION

VOLUME 3: DRAWINGS

JICA LIBRARY



1080031161

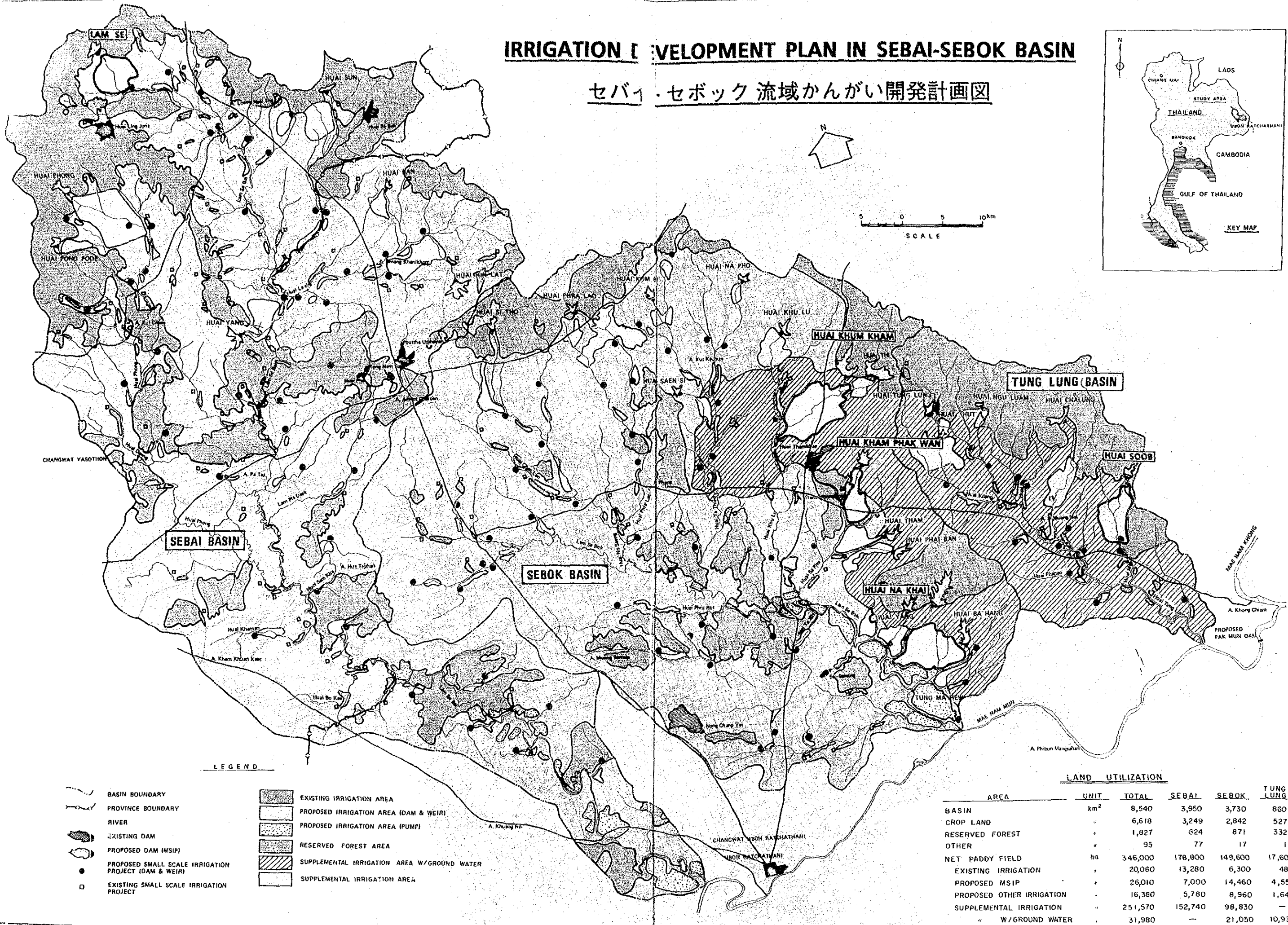
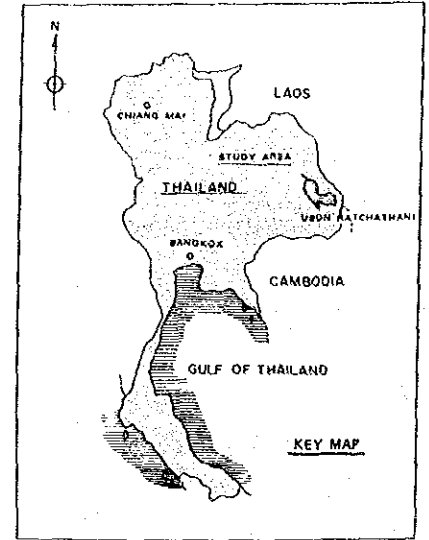
20567

FEBRUARY 1989

JAPAN INTERNATIONAL COOPERATION AGENCY

IRRIGATION DEVELOPMENT PLAN IN SEBAI-SEBOK BASIN

セバイ・セボック流域かんがい開発計画図



LEGEND

- BASIN BOUNDARY
- PROVINCE BOUNDARY
- RIVER
- EXISTING DAM
- PROPOSED DAM (MSIP)
- PROPOSED SMALL SCALE IRRIGATION PROJECT (DAM & WEIR)
- EXISTING SMALL SCALE IRRIGATION PROJECT
- EXISTING IRRIGATION AREA
- PROPOSED IRRIGATION AREA (DAM & WEIR)
- PROPOSED IRRIGATION AREA (PUMP)
- RESERVED FOREST AREA
- SUPPLEMENTAL IRRIGATION AREA W/GROUND WATER
- SUPPLEMENTAL IRRIGATION AREA

LAND UTILIZATION

AREA	UNIT	TOTAL	SEBAI	SEBOK	TUNG LUNG
BASIN	km ²	8,540	3,950	3,730	860
CROP LAND	"	6,618	3,249	2,842	527
RESERVED FOREST	"	1,827	624	871	332
OTHER	"	95	77	17	1
NET PADDY FIELD	ha	346,000	178,800	149,600	17,600
EXISTING IRRIGATION	"	20,060	13,280	6,300	480
PROPOSED MSIP	"	26,010	7,000	14,460	4,550
PROPOSED OTHER IRRIGATION	"	16,380	5,780	8,960	1,640
SUPPLEMENTAL IRRIGATION	"	251,570	152,740	98,830	-
W/GROUND WATER	"	31,980	-	21,050	10,930

BASIN DEVELOPMENT

NO.	TITLE
B-1	Location Map for Potential Water Resources Project Sites
B-2	Administration Boundaries, Population, Household and Village Number
B-3	Location of Hydrologic Observation Stations and Mean Annual Rainfall
B-4	Monthly Rainfall and Runoff at Stream Flow Station
B-5	Geological Map of Sebai-Sebok Basin
B-6	Hydrogeological Map of Sebai-Sebok Basin
B-7	Location Map of Groundwater Quality Investigation
B-8	Present Land Use Map
B-9	Forest Area Map
B-10	Backward Villages of Social Conditions in the Basin
B-11	Existing and Under-study Projects
B-12	Small Scale Existing Water Resources Projects (Reservoir and Weir)

FEASIBILITY STUDY FOR FIVE PROJECTS

NO.	TITLE
F-1	Soil Classification (1/5) Lam Se
F-2	ditto (2/5) Huai Khum Kham
F-3	ditto (3/5) Huai Kham Phak Wan
F-4	ditto (4/5) Huai Na Khai
F-5	ditto (5/5) Huai Soob
F-6	Land Classification(1/5) Lam Se
F-7	ditto (2/5) Huai Khum Kham
F-8	ditto (3/5) Huai Kham Phak Wan
F-9	ditto (4/5) Huai Na Khai
F-10	ditto (5/5) Huai Soob
F-11	Present Land Use (1/5) Lam Se
F-12	ditto (2/5) Huai Khum Kham
F-13	ditto (3/5) Huai Kham Phak Wan
F-14	ditto (4/5) Huai Na Khai
F-15	ditto (5/5) Huai Soob
F-16	Geological Profile (1/5) Lam Se
F-17	ditto (2/5) Huai Khum Kham
F-18	ditto (3/5) Huai Kham Phak Wan
F-19	ditto (4/5) Huai Na Khai
F-20	ditto (5/5) Huai Soob

FEASIBILITY STUDY FOR FIVE PROJECTS

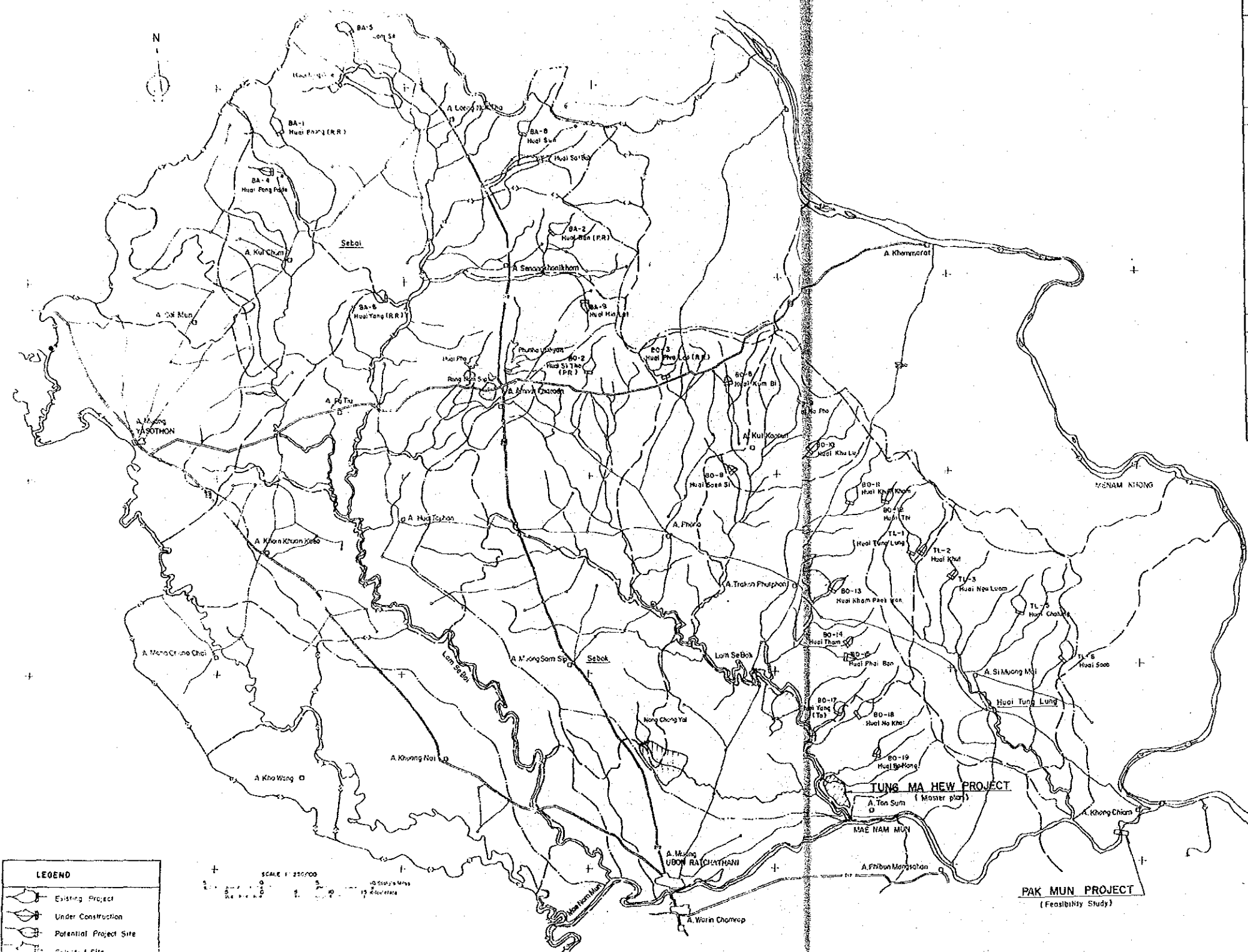
NO.	TITLE
F-21	Lugeon Map (1/5) Lam Se
F-22	ditto (2/5) Huai Khum Kham
F-23	ditto (3/5) Huai Kham Phak Wan
F-24	ditto (4/5) Huai Na Khai
F-25	ditto (5/5) Huai Soob
F-26	Lam Se Project, Reservoir Plan (1/3) Reservoir and Dam Site
F-27	ditto (2/3) Dam Profile and Section
F-28	ditto (3/3) Spillway and Outlet
F-29	Huai Khum Kham Project, Reservoir Plan (1/3) Reservoir and Dam site
F-30	ditto (2/3) Dam Profile and Section
F-31	ditto (3/3) Spillway and Outlet
F-32	Huai Kham Phak Wan Project, Reservoir Plan (1/3) Reservoir and Dam Site
F-33	ditto (2/3) Dam Profile and Section
F-34	ditto (3/3) Spillway and Outlet
F-35	Huai Na Khai Project, Reservoir Plan (1/3) Reservoir and Dam site
F-36	ditto (2/3) Dam Profile and Section
F-37	ditto (3/3) Spillway and Outlet
F-38	Huai Soob Project, Reservoir Plan (1/3) Reservoir and Dam site
F-39	ditto (2/3) Dam Profile and Section
F-40	ditto (3/3) Spillway and Outlet
F-41	Proposed Irrigation System (1/5) Lam Se
F-42	ditto (2/5) Huai Khum Kham
F-43	ditto (3/5) Huai Kham Phak Wan
F-44	ditto (4/5) Huai Na Khai
F-45	ditto (5/5) Huai Soob
F-46	Canal Profile (1/4) Lam Se, Huai Kham Phak Wan
F-47	ditto (2/4) Huai Khum Kham
F-48	ditto (3/4) Huai Na Khai
F-49	ditto (4/4) Huai Soob
F-50	Typical Cross Section of Canal and Pond
F-51	Canal Related Structure (1/5)
F-52	ditto (2/5)
F-53	ditto (3/5)
F-54	ditto (4/5)
F-55	ditto (5/5)
F-56	Irrigation Diagram (1/2) Lam Se, Kuai Khum Kham
F-57	ditto (2/2) Huai Kham Phak Wan, Huai Na Khai, Huai Soob

BASIN DEVELOPMENT

SEBAI SEBOK BASIN

LIST OF POTENTIAL PROJECT SITES

BASIN	PROJECT NAME	WATERSHED AREA (km ²)	RESERVOIR CAPACITY (MCM)	IRRIGABLE AREA (ha)	REMARKS	
SEBAI (BA)	BA-1: Huai Pheng	45.2	13.9	2,070		
	BA-2: Huai Ban	14.5	2.1	400		
	BA-4: Huai Pong Pade	8.7	3.4	463		
	BA-5: Lam So	22.4	9.7	940		
	BA-6: Huai Yong	25.0	4.6	630		
	BA-8: Huai Sun	13.7	8.9	1,200		
	BA-9: Huai Hin Lai	17.5	8.0	1,100		
	Sub-total	7 Projects	147.0	50.6	7,000	
	SEBOK (BO)	BO-2: Huai Si Tho	28.2	8.0	1,140	
BO-3: Huai Pha Lon		23.0	6.2	1,100		
BO-6: Huai Kam Bi		16.4	1.1	230		
BO-8: Huai Soen Si		25.0	1.7	310		
BO-9: Huai Na Pho		26.4	0.3	50		
BO-10: Huai Khu Lu		44.7	6.3	1,130		
BO-11: Huai Khom Khom		36.8	22.0	3,400		
BO-12: Huai Tai		38.4	3.3	590		
BO-13: Huai Khom Phai Wan		13.5	10.6	1,540		
BO-14: Huai Thom		17.0	5.0	900		
BO-15: Huai Phai Ban		21.2	4.8	860		
BO-17: Huai Yang		14.6	6.5	830		
BO-18: Huai Ke Khar		31.3	18.3	2,000		
BO-19: Huai Ban Huang		51.1	3.1	563		
Sub-total		14 Projects	387.8	97.2	14,460	
HUAI TUNG LUNG (TL)		TL-1: Huai Tung Lung	40.3	7.8	1,460	
		TL-2: Huai Khai	18.8	1.2	220	
		TL-3: Huai Ngo Lam	15.4	2.9	520	
		TL-5: Huai Chalung	35.7	6.7	1,250	
	TL-6: Huai Soab	18.5	8.2	1,100		
	Sub-total	5 Projects	124.7	26.8	4,550	
TOTAL	26 Projects	659.5	174.0	26,010		



LEGEND

- Existing Project
- Under Construction
- Potential Project Site
- Reconnaissance Site

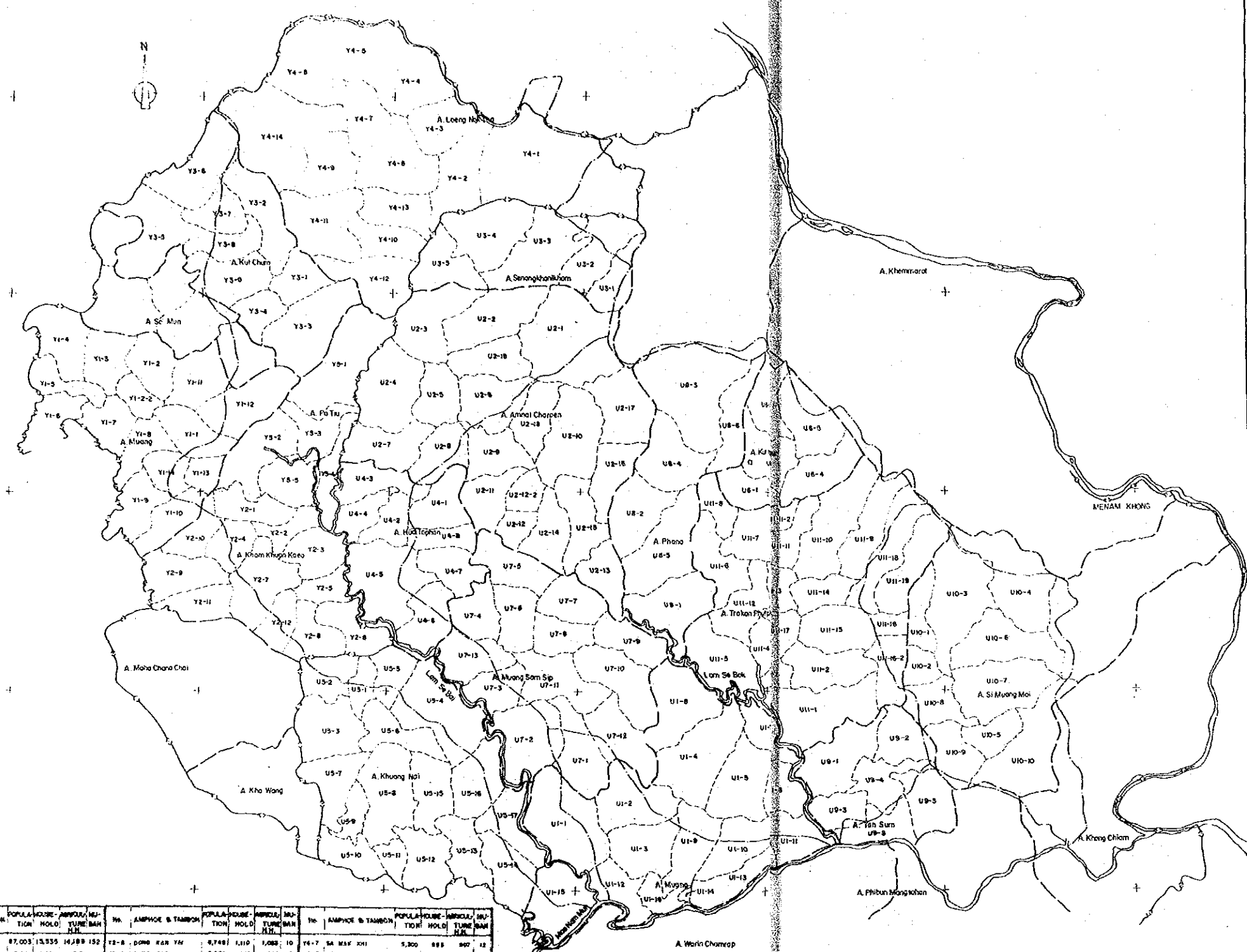
P.R. Pre-feasibility Report
R.R. Reconnaissance Reports

SCALE 1:250,000

THE FEASIBILITY STUDY OF
SEBAI-SEBOK BASIN DEVELOPMENT PROJECT
IN THE NORTHEAST REGION (RID)

LOCATION MAP FOR
POTENTIAL WATER RESOURCES
PROJECT SITES

UBON RATCHATHANI



No	AMPHOE & TAMBON	POPULATION	HOUSEHOLD	AGRICULTURE	MUNICIPALITY	No	AMPHOE & TAMBON	POPULATION	HOUSEHOLD	AGRICULTURE	MUNICIPALITY
U1	A. MUANG	12,644	18,112	14,307	173	U6	A. KUT KAO PUN	29,427	4,504	4,352	59
U1-1	NONG KHON	13,345	1,782	1,394	18	U6-1	KA BUN	4,103	648	684	12
U1-2	MOI BANG	10,701	1,274	1,282	14	U6-2	NOAN SARANG	7,970	1,208	1,180	15
U1-3	MOI BANG	14,775	2,049	1,988	13	U6-3	KUT KAO PUN	6,823	1,050	978	13
U1-4	LAD SIA KOK	10,405	1,489	1,401	18	U6-4	KENG KENG	5,264	741	708	10
U1-5	KUM MAI YAI	6,396	1,189	1,125	19	U6-5	NONG TAN NAM	5,953	809	800	8
U1-6	LAD SIA KOK	6,389	842	703	11	U7	A. MUANG SAM SIP	7,372	11,071	10,623	144
U1-7	THA MUANG	4,827	721	683	6	U7-1	NONG KAI MOK	6,880	729	719	13
U1-8	POKE MUANG	6,420	848	829	10	U7-2	NONG LAD	5,230	816	811	15
U1-9	RAI MOI	6,928	1,033	1,037	13	U7-3	NONG HANG	6,451	961	974	6
U1-10	MOI BANG	4,489	870	807	10	U7-4	PHAI YAI	4,980	890	869	12
U1-11	DOM MOI DAENG	6,442	1,037	933	10	U7-5	LAD BOX	5,189	836	808	11
U1-12	CHAI RA MAE	5,178	1,433	1,477	8	U7-6	TANG YO PHAP	7,318	1,131	1,124	11
U1-13	KUT LAD	7,444	1,209	1,123	5	U7-7	DOOH YAI	5,244	811	803	12
U1-14	PAI THUM	7,108	1,098	1,048	13	U7-8	NONG MUANG	6,926	1,040	1,008	10
U1-15	NONG BO	6,704	1,035	1,068	13	U7-9	NONG CHANG YAI	3,522	649	636	6
U1-16	MUNICIPAL AREA	-	-	-	-	U7-10	TOEI	7,185	1,067	1,004	12
U2	A. ANNAT CHANOEI	10,545	22,926	19,150	238	U7-11	MUANG SAM SIP	9,794	1,389	1,102	11
U2-1	KUEN TAI	7,702	1,857	1,821	13	U7-12	TANG SAM KA PO LDOM	4,741	782	713	10
U2-2	NA PHUE	6,318	1,350	1,383	14	U7-13	NA LEANG	3,777	682	579	9
U2-3	NA MU NA	3,482	993	981	15	U8	A. PHANA	44,502	7,462	7,138	78
U2-4	NA MU NA	7,408	1,236	1,233	15	U8-1	CHAI LAN	7,892	1,587	1,441	13
U2-5	NOAN PO	4,310	723	747	9	U8-2	MAI KLONG	4,192	957	893	12
U2-6	BUNB	20,124	4,092	3,293	17	U8-3	NA VA	6,288	1,634	1,528	13
U2-7	HAN PLEAK	6,829	1,300	1,140	9	U8-4	LUE	5,982	988	981	15
U2-8	NA CHIK	9,787	1,090	1,028	13	U8-5	PHANA	10,350	1,765	1,999	18
U2-9	KAI KUM	6,830	1,047	1,025	11	U8-6	KUAI	5,388	824	820	11
U2-10	SAKHA NOK YA	4,818	1,340	1,508	19	U9	KING A. TAN SUM	24,493	3,875	3,543	55
U2-11	DOM MA TANG	7,186	1,180	1,129	17	U9-1	NA KWAI	4,913	688	677	13
U2-12	MAET	7,488	1,241	1,119	19	U9-2	NONG KUNG	3,188	581	508	6
U2-13	PAI SHI	3,739	630	627	10	U9-3	CHIK TAENG	4,082	684	608	6
U2-14	POE	8,286	933	947	12	U9-4	KUM MA	2,819	448	397	6
U2-15	DOM BANG	3,444	846	874	13	U9-5	SAM BONG	2,845	440	402	7
U2-16	PLA KLAO	4,920	827	835	11	U9-6	TAN SUM	6,435	1,114	954	14
U2-17	LAD PHUM	9,208	878	897	12	U10	A. SRI MUANG MAI	44,449	7,875	7,103	102
U2-18	MUAI BAI	4,028	878	870	8	U10-1	TA BAI	2,487	489	488	9
U2-19	NOAN NAM THANG	4,165	701	645	9	U10-2	DOO YAI	2,648	541	508	8
U3	A. SENANGKHANHOM	32,400	5,283	5,192	50	U10-3	EDOS YANG	4,124	747	708	13
U3-1	NONG MA	5,194	788	788	7	U10-4	NA LIN	1,883	353	354	5
U3-2	POKE THONG	4,026	782	708	9	U10-5	DOAN YAI	4,055	702	684	10
U3-3	SENANGKHANHOM	9,977	1,834	1,798	13	U10-6	LAD KWAI	2,823	571	528	7
U3-4	RAM SI SUK	7,421	1,516	1,524	15	U10-7	NA KUM	6,876	1,549	1,474	12
U3-5	NA WANG	5,623	879	850	8	U10-8	KANG KOK	3,848	634	616	7
U4	A. WUA YA PHAN	42,400	7,195	6,832	76	U10-9	WARU	7,174	1,228	1,193	17
U4-1	KENG YAI	5,201	808	849	10	U10-10	KUM LAI	6,645	1,041	1,012	14
U4-2	RATTANA WARI	3,558	641	634	7	U11	A. TRAKHAN PHATHON	92,468	14,535	13,343	201
U4-3	SOM PHOA	5,815	943	913	12	U11-1	TRAKHAN	4,015	683	682	9
U4-4	WUA YA PHAN	5,718	879	859	8	U11-2	KOKE CHAN	3,370	591	626	9
U4-5	TRANG THO MOI	7,088	1,170	1,111	10	U11-3	SA PUE	4,676	760	725	7
U4-6	CHIK DOO	6,009	1,006	989	8	U11-4	SE PEO	3,059	473	430	5
U4-7	POKE MUANG MOI	5,911	1,006	990	10	U11-5	KHAN PIA	4,454	867	809	12
U4-8	NONG KEAO	3,731	638	618	10	U11-6	NA LAMAI	4,837	780	747	10
U5	A. KHUANG MAI	94,251	15,372	14,432	155	U11-7	PAO	4,275	628	608	9
U5-1	BAK KOK	2,212	579	538	6	U11-8	NONG TAO	2,594	457	407	7
U5-2	KLANG YAI	5,917	808	885	10	U11-9	THAN THAE	2,879	458	445	5
U5-3	BAK THAI	4,844	1,082	1,073	11	U11-10	KON SAI	5,004	954	921	15
U5-4	SRI SUK	6,500	1,433	1,447	14	U11-11	KASEM	3,470	1,346	1,317	10
U5-5	NOAN RUNG	3,400	610	603	6	U11-12	KUT YA LUAN	6,446	1,018	985	9
U5-6	TANG KHU MOI	4,768	728	720	8	U11-13	LAI THUNG	12,382	1,743	1,653	15
U5-7	KHO THONG	5,226	908	880	8	U11-14	KUM LU	4,140	868	842	8
U5-8	SRANG THO	6,222	1,284	1,204	14	U11-15	KUSSA KORN	3,025	517	487	6
U5-9	SA NA THAT	2,340	407	393	7	U11-16	TAK DAD	3,637	504	481	6
U5-10	THAT MOI	5,994	881	881	7	U11-17	MUA PAI PATTANA	4,130	689	652	11
U5-11	QANG MOI	3,394	454	445	6	U11-18	NA PH	3,819	627	601	11
U5-12	NA KUM YAI	3,658	541	558	8	U11-19	THA LUANG	2,813	354	354	8
U5-13	THA HAI	6,182	1,091	781	8						
U5-14	SRI TUAN	5,018	899	891	11						
U5-15	KHUANG MAI	8,196	1,503	1,100	11						
U5-16	KO LA	6,500	1,096	1,058	11						
U5-17	MUA DOM	3,913	822	786	9						

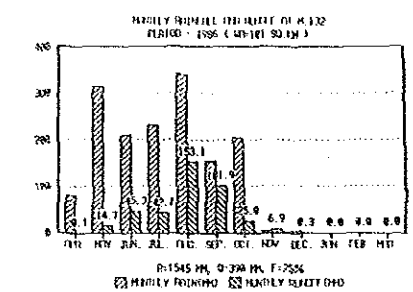
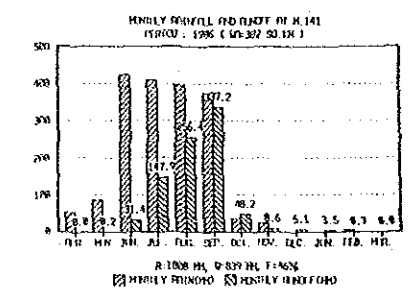
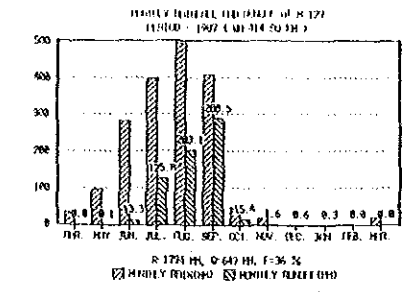
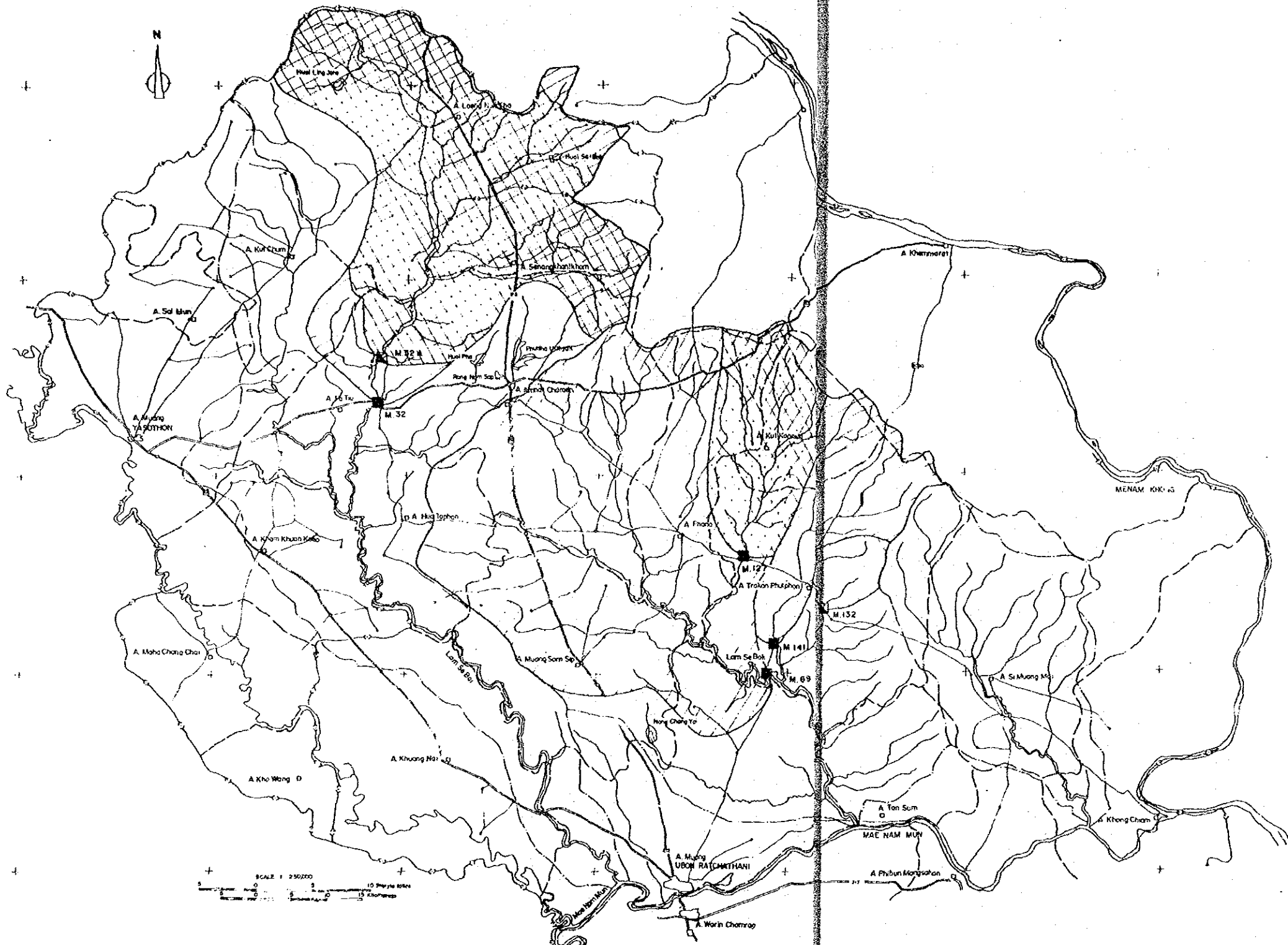
YASOTHON

No	AMPHOE & TAMBON	POPULATION	HOUSEHOLD	AGRICULTURE	MUNICIPALITY	No	AMPHOE & TAMBON	POPULATION	HOUSEHOLD	AGRICULTURE	MUNICIPALITY
Y1	A. MUANG	87,003	13,335	12,889	152	Y2	A. LOENG NONG THA	9,101	18,816	15,709	144
Y1-1	BUN	7,881	1,144	1,113	15	Y2-1	BUN KA	6,522	1,841	1,482	11
Y1-2	THUNG YAI	7,877	1,358	1,319	14	Y2-2	KONG SAMRAN	6,863	1,841	1,420	10
Y1-3	THUNG KANG OAK	2,877	1,358	1,319	14	Y2-3	SAM YAK	5,087	1,458	1,189	12
Y1-4	KAR DAN TH	6,416	1,044	1,033	12	Y2-4	KUT YAI	6,590	1,137	1,042	8
Y1-5	DOED	7,340	1,374	1,383	10	Y2-5	CHIANG NIE	6,617	1,238	1,120	11
Y1-6	DOO THUNG	4,303	601	778	8	Y2-6	SADAT	11,189	2,017	1,854	12
Y1-7	KHO NUA	6,820	1,103	1,071	13						
Y1-8	SAMPAN	5,774	919	782	9						
Y1-9	KAM KUM YAI	6,281	1,316	1,032	14						
Y1-10	KHANG KUM	5,729	1,029	900	10						
Y1-11	KUM MOUEN	4,339	782	745	6						
Y1-12	NA SA MAI	4,218	849	897	12						
Y1-13	NONG NIN	7,809	1,278	1,284	13						
Y1-14	NONG KOD	4,033	906	851	9						
Y1-15	TAD THONG	2,814	1,287	1,054	18						

LEGEND
 - - - - - PROVINCE BOUNDARY
 - - - - - AMPHOE BOUNDARY
 - - - - - TAMBON BOUNDARY
 - - - - - PROJECT AREA BOUNDARY

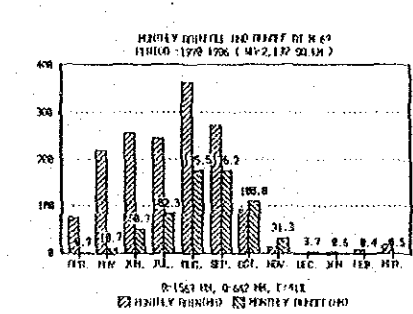
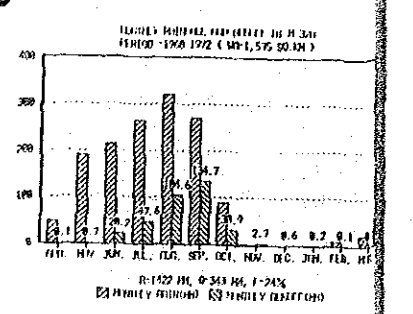
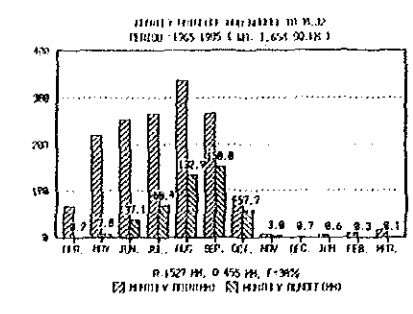
SCALE 1:250,000

THE FEASIBILITY STUDY OF
 SEBAI-SEBOK BASIN DEVELOPMENT PROJECT
 IN THE NORTHEAST REGION (RID)
 ADMINISTRATIVE BOUNDARIES, POPULATION,
 HOUSEHOLD AND VILLAGE NUMBER
 NO. B-2 JAPAN INTERNATIONAL COOPERATION AGENCY



LEGEND

■ M. 69	STREAMFLOW RATING STATION WITH STAFF GAGE / RECORDER
□ M. 132	DISCONTINUED STREAMFLOW RATING STATION



THE FEASIBILITY STUDY OF
SEBAI-SEBOK BASIN DEVELOPMENT PROJECT
IN THE NORTHEAST REGION (RID)

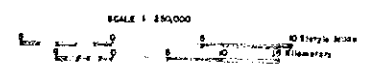
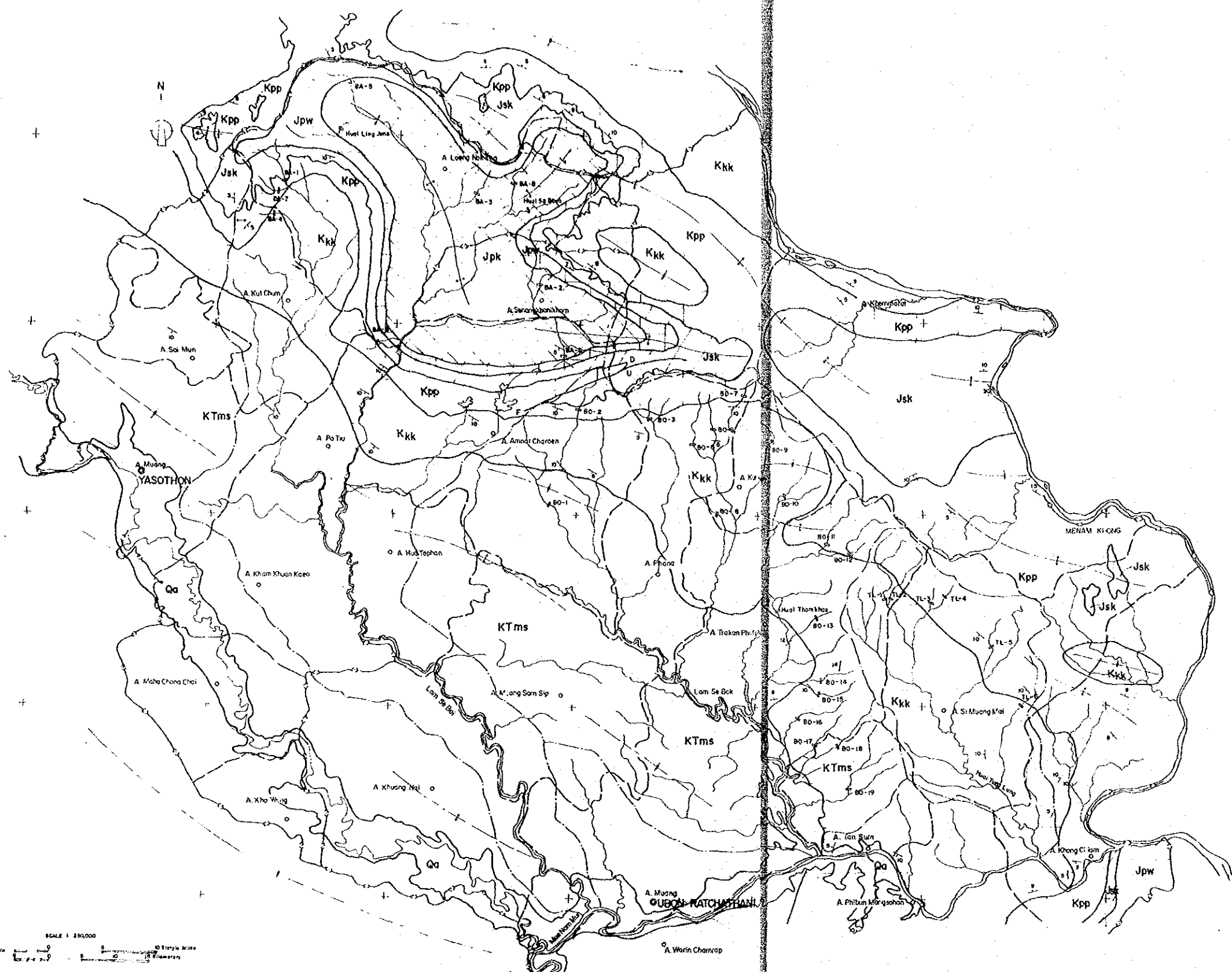
MONTHLY RAINFALL AND RUNOFF
AT STREAMFLOW STATIONS

NO B-4 JAPAN INTERNATIONAL COOPERATION AGENCY

LEGEND

FORMATION	AGE
Qa	Quaternary
KTms	Cretaceous-Tertiary
Kkk	Middle-Upper Cretaceous
Kpp	Lower-Middle Cretaceous
Jsk	Middle-Upper Jurassic
Jpw	Lower-Middle Jurassic
Jpk	Lower Jurassic

	Boundary of formation
	Fault U: up thrown side D: down thrown side
	Syncline with plunge
	Anticline with plunge
	Strike and dip of bed
	River
	Reservoir
	Proposed site for dam
	Boundary of Basin
	Boundary of Amphoe (District)
	Boundary of Changwat (Province)
	Amphoe (District)
	Changwat (Province)



EXPLANATION OF FORMATIONS

Formation	Sediments and Rocks	Formation	Sediments and Rocks	Formation	Sediments and Rocks
Qa	Alluvial deposits Gravel, sand, silt and clay	Kpp	Phu Phan F. Sandstone white, pale-orange commonly pebbly with pebbles of quartz, chert and igneous rocks of up to 5 cm. in diameter cross-bedded, with shale and conglomerate	Jpw	Phra Wihan F. Sandstone white and pink, orthoquartzitic and massive, pebble layering on the upper bed, cross-bedded with some reddish-brown and gray shale
KTms	Maha Sarakham F. Siltstone, shale, sandstone and mudstone, brick-red, purplish-red, weathered to white and gray, with rock salt, potash, gypsum and anhydrite	Jsk	Sao Khua F. Sandstone reddish-brown and gray, micaceous Siltstone and shale gray, brown, purplish-brown and brick-red Conglomerate lime-noduled	Jpk	Phu Kradung Shale brown, reddish-brown and purplish-red, micaceous Siltstone and Sandstone brown and gray, micaceous and small scale cross-bedded Conglomerate lime-noduled
Kkk	Khok Krud F. Sandstone brown, reddish-brown, grayish-green mottled, weathered to brown and grayish-black, fine- to medium-grained, poor-sorted Shale and Siltstone pale-brown, micaceous Conglomerate lime-noduled				

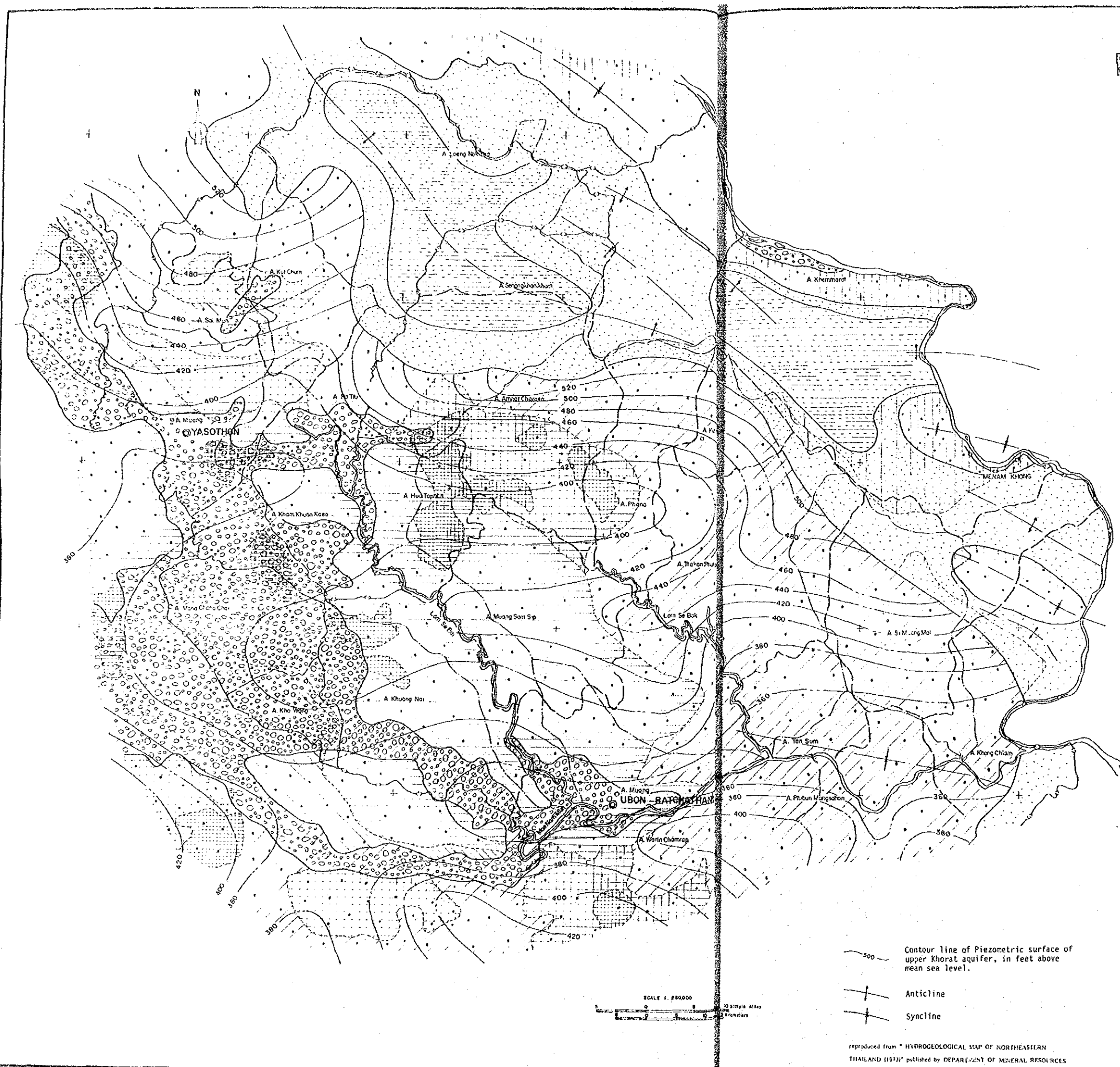
compiled from the GEOLOGICAL MAP OF THAILAND
1:250,000 MUANGKE PON AND SARAWAN, CHANG-
WAT ROI ET and CHANGWAT UBON RATCHATHANI

THE FEASIBILITY STUDY OF
SEBAI-SEBOK BASIN DEVELOPMENT PROJECT
IN THE NORTHEAST REGION (R10)

**GEOLOGICAL MAP OF
SEBAI AND SEBOK BASIN**

SCALE 1:250,000

B-5 INTERNATIONAL COOPERATION AGENCY



LEGEND

- Unconsolidated aquifers (Holocene)**
older and younger alluvium in river terraces and active flood plains.
- Gravelly and sandy deposits, Yield range 50-200 gpm.**
More than 90% of wells have water excluding salt.
- Sandy and clayey deposits within flat bedrock terraces.**
Yield range 30-50 gpm. About 95% of wells have water excluding salt.
- Sandy or clayey deposits along river courses including natural levees. Inplaces contaminated with salty water.**
Yield range 10-50 gpm. About 80% of wells have water excluding salt.
- Sandy, silty and clayey deposits on salt bearing bedrocks.**
Almost 100% of wells have brackish to salty water. Very shallow water wells may yield fresh to brackish water.
- Upper Khorat aquifers (Cretaceous)**
red, reddish brown and grayish brown shale, siltstone and sandstone of Salt and Khok Kruat F.
- Medium high terraces. Well depth not over 200 feet.**
Average yield is 100-150 gpm. More than 95% of wells have water excluding salt.
- Mound and depression-type topography with remnants of erosional surface. Depth to water bearing zones may reach 400 feet. Yield range is 20-100 gpm. About 80% of wells have water excluding salt.**
- Low terraces relatively flat surfaced, underlain by soft shale and siltstone. Yield range 20-50 gpm. About 80% of wells have water excluding salt.**
- Low ridge and valley type topography, mostly underlain by Khok Kruat F. Yield range less than 30 gpm. Many wells are dry. 80% of wells yield fresh water.**
- Flood plain or paddy field, flooded in rainy season. Yield fresh water only in spot of high relief. Not over 50% of wells yield fresh water.**
- Flood plain and isolated, depression within areas of higher relief. Efflorescence salt commonly occurs on ground surface. More than 90% of wells yield salty water. Shallow fresh water only in spots of high relief by obtained.**
- Middle Khorat aquifers (Jurassic)**
yellowish gray, grayish pink massive sandstone and conglomerate of Phu Phan F. on top, dark reddish brown, brownish gray shale and siltstone of Sao Khua F. in middle, grayish red, olive gray, white massive thick bedded quartzose sandstone of Phra Mihan F. at bottom.
- Escarpment, cuestas, isolated hills. Groundwater developed along dip slopes or striked valleys may be obtained from about 50% of wells drilled. Yield range less than 20 gpm. Water excluding salt.**
- Eroded surfaces of former cuestas or dip slopes where high artesian head is obtained. Flow rate in artesian wells less than 20 gpm.**
- Lower Khorat aquifers (upper Triassic to Jurassic)**
darkbrown, grayish brown and variegated shale, soft slabby micaceous sandstone of Phu Kradung F., siltstone, thick sandstone and conglomerate of Nam Phon F.
- Penplain-type topography. Yield range is 20-100 gpm. from depth of 80-200 feet. Almost 100% of wells have water excluding salt.**

— 500 — Contour line of Piezometric surface of upper Khorat aquifer, in feet above mean sea level.

— + — Anticline

— - — Syncline

SCALE 1:200,000

0 10 Statute Miles

0 2 Kilometers

reproduced from "HYDROGEOLOGICAL MAP OF NORTHEASTERN THAILAND (1971)" published by DEPARTMENT OF MINERAL RESOURCES

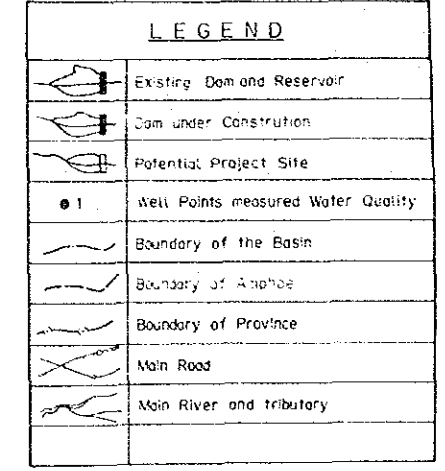
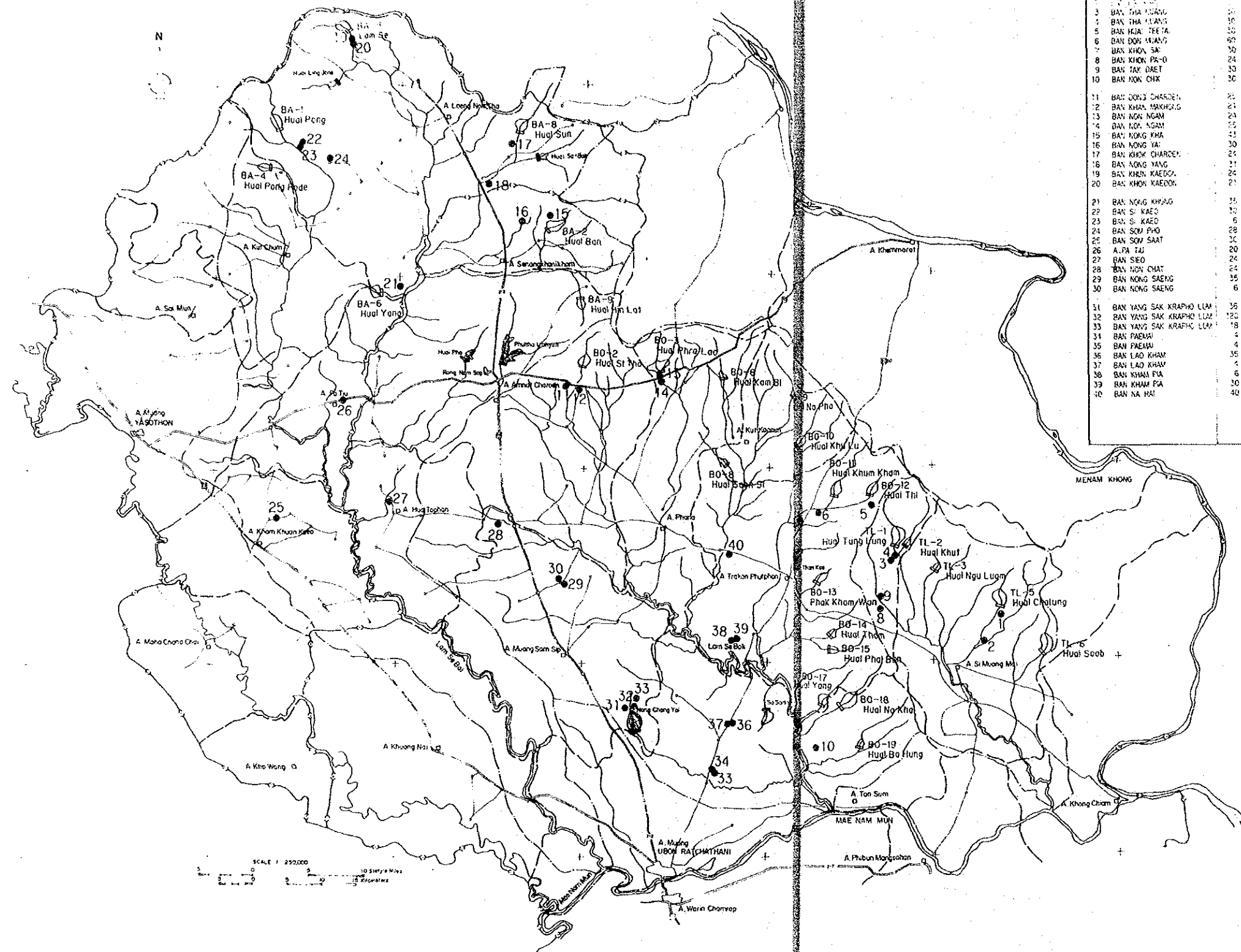
**THE FEASIBILITY STUDY OF
SEBAI-SEBOK BASIN DEVELOPMENT PROJECT
IN THE NORTHEAST REGION (RID)**

**HYDROGEOLOGICAL MAP OF
SEBAI AND SEBOK BASIN**

NO. **B-6** JAPAN INTERNATIONAL COOPERATION AGENCY

Table Groundwater Quality In the Study Area

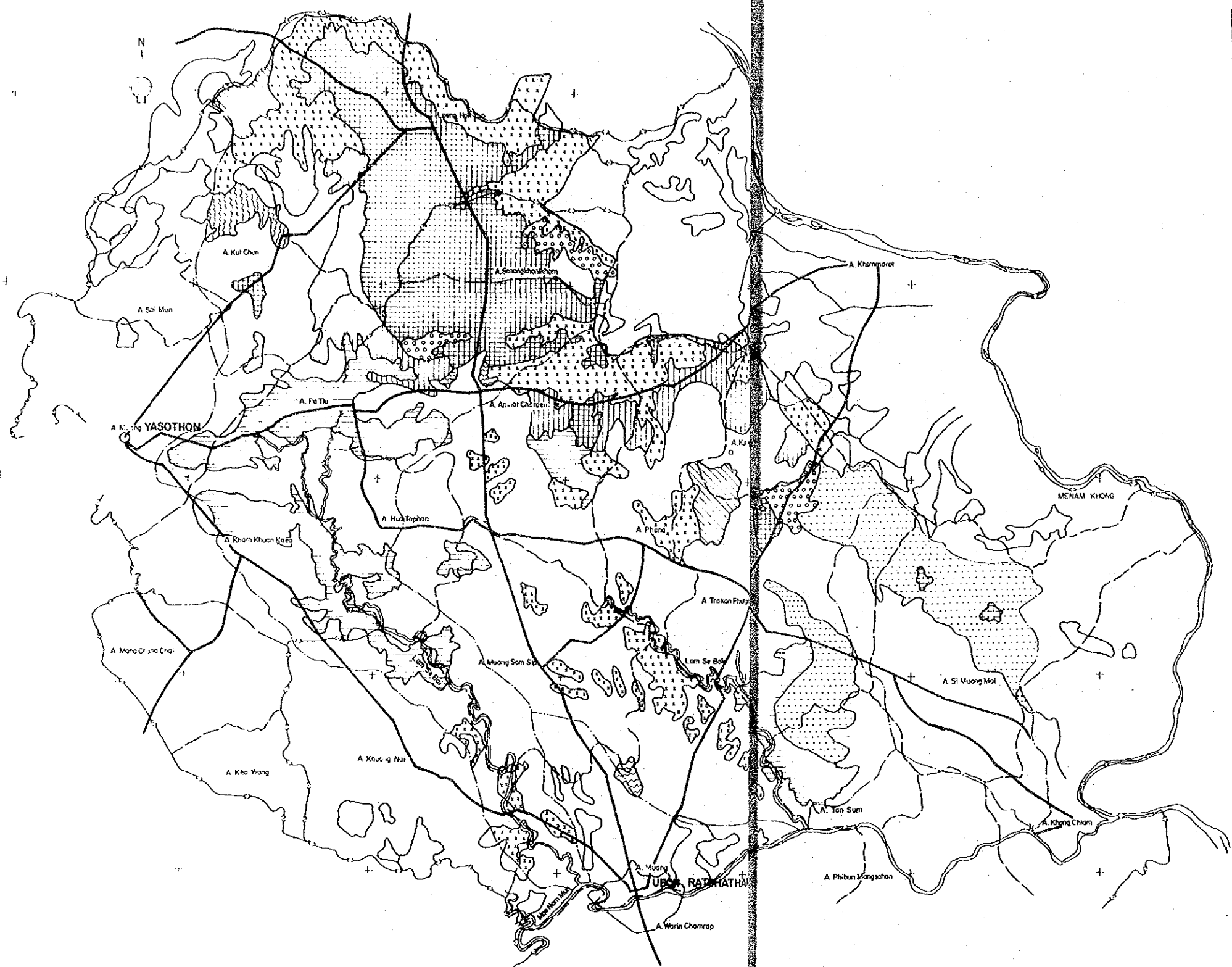
No.	Locality	Depth (m)	Turbidity (ppm)	Conductivity (µmhos/cm)	pH	Temperature (°C)	Remarks
1	BAN KHON KHAI	10	472.0	47.0	6.91	26.1	By ARD
2	BAN KHON KHAI	10	24.1	46.1	6.95	26.1	By ARD
3	BAN THA LUANG	10	24.1	46.1	7.86	26.1	By ARD
4	BAN THA LUANG	10	15.0	61.1	7.61	25.0	By ARD
5	BAN KHAI THE TA	10	30.0	51.0	7.56	29.1	By ARD
6	BAN DON MUANG	60	57.0	74.0	7.03	29.6	By ARD
7	BAN KHON SA	30	14.5	40.5	7.42	29.4	By ARD
8	BAN KHON PA-O	24	41.8	92.0	6.04	27.9	By ARD
9	BAN TAY DAET	30	69.5	234.0	7.81	29.4	By ARD
10	BAN NON CHK	30	26.1	32.9	7.72	29.3	By ARD
11	BAN DONJ CHAROEN	25	21.2	16.2	6.85	28.6	By ARD
12	BAN KHAN KHANG	24	22.1	15.7	6.58	26.2	By ARD
13	BAN NON NGAM	24	21.6	101.0	7.79	29.0	By ARD
14	BAN NON NGAM	10	12.2	84.0	6.56	28.9	By ARD
15	BAN NONG KHA	43	16.4	71.0	7.86	29.3	By ARD
16	BAN NONG YA	30	18.2	94.0	7.52	29.2	By ARD
17	BAN KHOK CHAROEN	24	20.7	48.6	7.42	28.4	By ARD
18	BAN NONG YANG	11	24.0	118.0	7.35	28.2	By ARD
19	BAN KHON KAEDON	24	10.1	63.0	7.25	29.7	By ARD
20	BAN KHON KAEDON	21	10.1	78.0	5.65	28.5	By ARD
21	BAN NONG KHANG	35	25.1	174.0	7.21	29.2	By ARD
22	BAN SI KAEO	30	11.2	33.4	6.89	28.7	By ARD
23	BAN SI KAEO	6	11.6	24.8	5.54	29.0	By ARD
24	BAN SOM PHO	28	11.9	14.3	7.06	30.3	By ARD
25	BAN SOM SAAT	30	27.2	10.6	6.05	28.8	By ARD
26	A. RA TAI	20	170.3	87.0	7.19	29.1	By ARD
27	BAN SEO	24	45.0	103.0	6.18	28.4	By ARD
28	BAN NON CHAT	24	22.8	9700.0	8.10	29.6	By ARD
29	BAN NONG SAENG	15	16.9	42.9	7.01	28.8	By ARD
30	BAN NONG SAENG	6	32.1	45.0	6.23	27.1	By ARD
31	BAN YANG SAK KRAPHO LAM	35	182.0	40.4	7.48	30.1	By ARD
32	BAN YANG SAK KRAPHO LAM	120	14.0	180.0	6.89	29.5	By ARD
33	BAN YANG SAK KRAPHO LAM	18	27.4	18.7	8.25	25.9	By ARD
34	BAN PAEMAI	4	35.9	28.7	5.55	26.8	By ARD
35	BAN PAEMAI	4	33.1	6.2	6.21	26.9	By ARD
36	BAN LAO KHAM	35	30.8	11.5	7.21	28.1	By ARD
37	BAN LAO KHAM	1	32.3	14.4	6.56	25.9	By ARD
38	BAN KHAI PA	6	60.6	16.1	6.76	26.6	By ARD
39	BAN KHAI PA	30	33.2	5.2	6.41	25.7	By ARD
40	BAN NA HAI	40	33.2	62.7	7.82	28.9	By ARD



THE FEASIBILITY STUDY OF
SEBAI-SEBOK BASIN DEVELOPMENT PROJECT
IN THE NORTHEAST REGION (RID)

**LOCATION MAP OF
GROUNDWATER
QUALITY INVESTIGATION**

NO. B-7 JAPAN INTERNATIONAL COOPERATION AGENCY



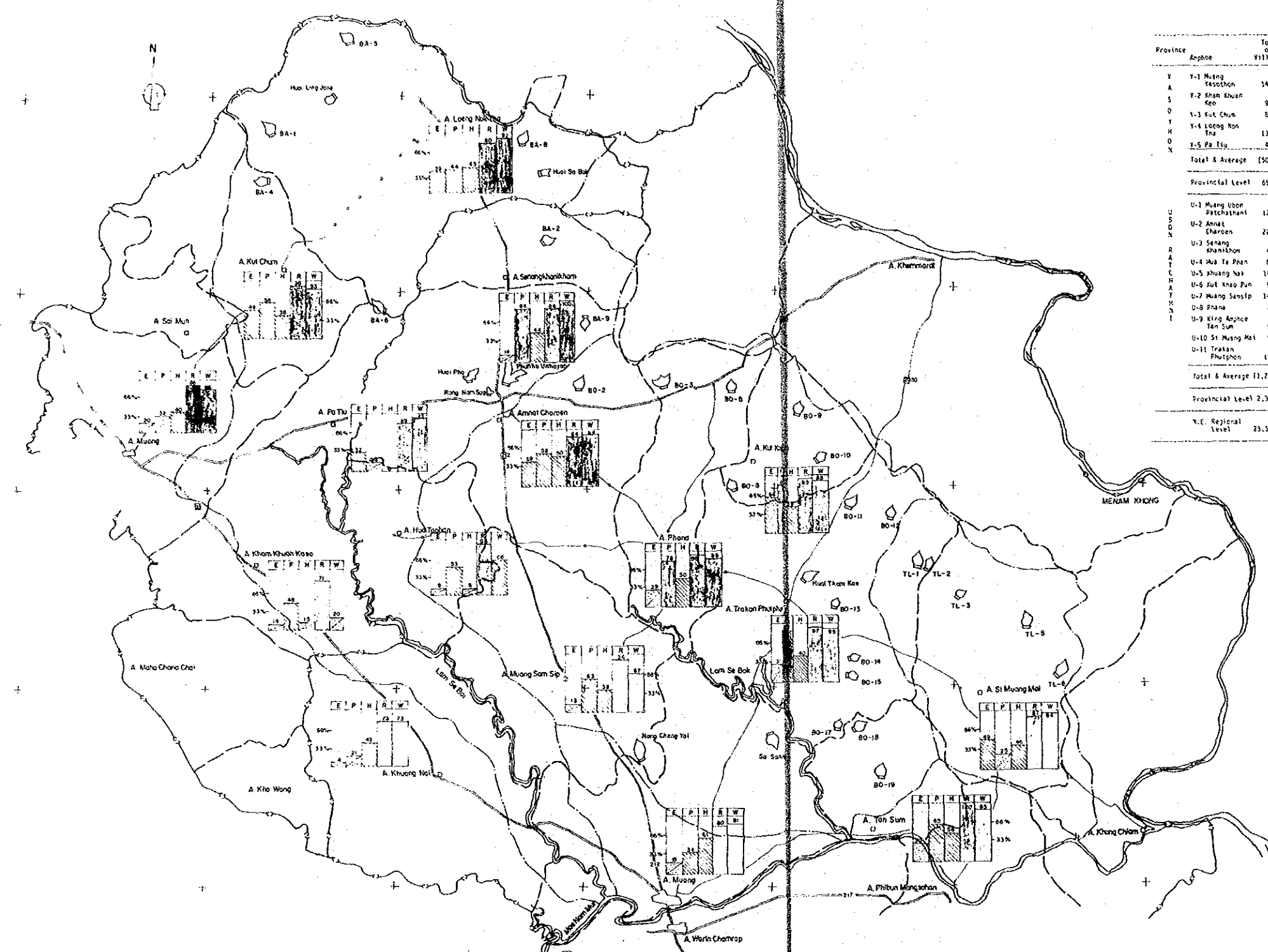
LEGEND

MAPPING UNIT	DESCRIPTIONS	AREA	
		ha	%
	PADDY FIELD	105,300	12.3
	PADDY FIELD AND RANGE LAND	442,100	51.8
	FIELD CROP	55,900	6.7
	FIELD CROP AND PADDY FIELD	21,800	2.5
	FIELD CROP AND RANGE LAND	25,500	3.0
	FIELD CROP AND FOREST LAND	10,200	1.2
	RANGE LAND	11,000	1.3
	RANGE LAND AND FOREST LAND	58,700	6.9
	FOREST LAND	113,000	13.2
	WET LAND	5,700	0.7
	RESERVOIR	2,100	0.2
	VILLAGE AND OTHERS	1,500	0.2
	TOTAL	854,000	100

SCALE 1:200,000
 0 5 10 Kilometers
 0 5 10 Miles

THE FEASIBILITY STUDY OF
 SEBAI-SEBOK BASIN DEVELOPMENT PROJECT
 IN THE NORTHEAST REGION (RID)

PRESENT LAND USE MAP



SCALE 1:250000
 0 5 10 Kilometers
 0 5 10 Miles

Province	Ampoe	Total of Villages	Electrification		Profession		Public Health		Rice Cultivation		Water for Drink	
			Number	%	Number	%	Number	%	Number	%	Number	%
YASOTHAN	Y-1 Muang Yasothon	143	28	20	46	32	57	40	126	89	121	86
	Y-2 Khan Khuan Koo	91	13	14	42	46	14	15	65	71	38	20
	Y-3 Kut Chum	88	44	49	51	56	31	36	87	96	85	93
	Y-4 Loeng Non	138	54	39	61	44	62	45	111	80	127	92
	Y-5 Pa Ety	41	15	37	9	22	0	0	36	89	40	98
Total & Average		(502)	(164)	31	(211)	42	(166)	33	(425)	85	(392)	78
Provincial Level		655	195	30	269	41	209	37	565	87	506	77
URUTSANG	U-1 Muang Ubon Patchasani	173	32	18	59	31	106	61	138	80	140	81
	U-2 Anant Charoen	229	39	17	132	58	115	50	192	84	203	89
	U-3 Senang Khamkhon	43	6	14	37	86	19	44	37	86	45	100
	U-4 Hua Ta Phan	64	5	8	34	53	5	8	61	95	42	66
	U-5 Khuang Nak	140	5	4	29	21	60	43	101	73	102	73
	U-6 Kut Khap Pun	59	38	64	49	83	23	39	58	99	52	88
	U-7 Muang Samsit	141	18	13	89	63	53	36	113	81	95	67
	U-8 Phana	72	21	29	36	78	36	50	69	96	62	66
	U-9 King Amphoe Tan Sum	54	16	30	35	65	30	56	54	100	46	65
	U-10 Si Muang Mai	95	47	49	24	25	44	46	83	87	89	94
	U-11 Trahan Phutphon	191	60	31	167	87	77	40	185	97	182	95
Total & Average		(1,261)	(267)	23	(711)	56	(568)	45	(1,112)	85	(1,056)	84
Provincial Level		2,330	751	34	1,272	56	1,111	48	1,426	83	1,329	81
N.E. Regional Level		23,373	7,116	30	9,631	41	11,504	51	16,072	69	16,673	71

NOTE

- By survey on village development level, Thailand authorities (NESDB, COD) classified the villages by 3 categories as:
 Backward level is lower than average of the country by No. 1
 Middle level is equal to average of the country by No. 2
 Progressive ... level is over than average of the country by No. 3
- Number of villages in the table corresponds to No. 1 categories while share is the percentage of the number in total of village.

LEGEND

- Ampoe Boundary
- Dar Site with No.
- High Way
- Major Road
- E : Electrification
- P : Profession
- H : Public Health in village
- R : Rice Cultivation
- W : Water Supply for Drinking and Use
- over 60
- 33
- below 22

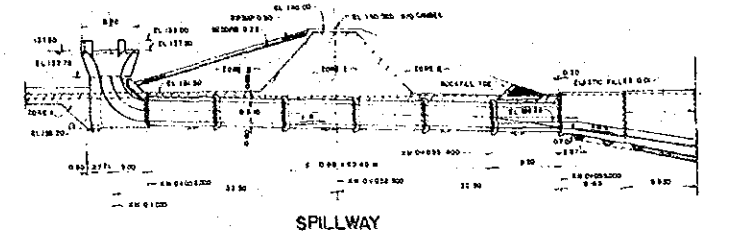
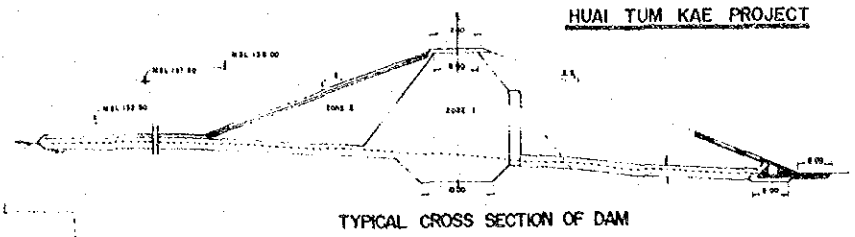
THE FEASIBILITY STUDY OF
SEBAI-SEBOK BASIN DEVELOPMENT PROJECT
 IN THE NORTHEAST REGION (RID)

**BACKWARD VILLAGES OF
 SOCIAL CONDITIONS
 IN THE BASIN**

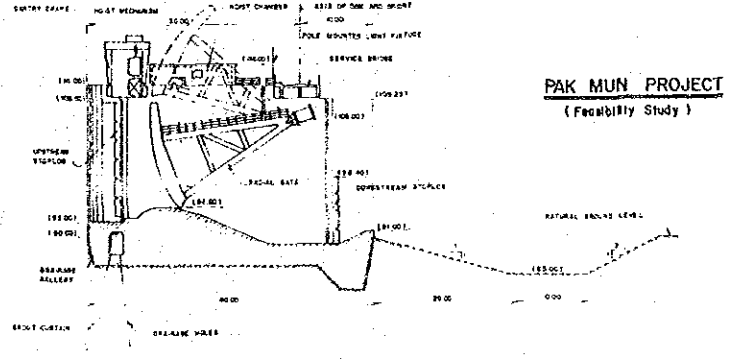
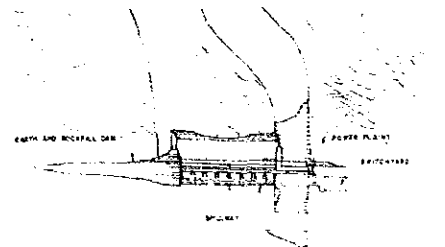
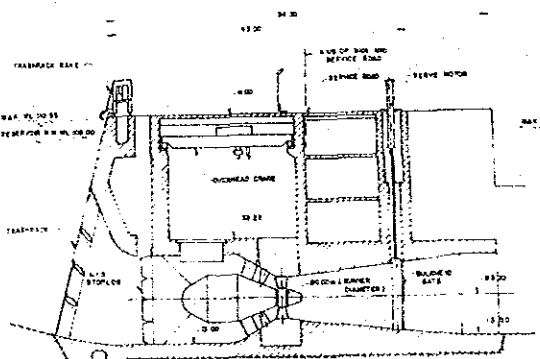
NO. B-10 JAPAN INTERNATIONAL COOPERATION AGENCY

UNDER CONSTRUCTION DAMS

DIMENSION	HUAI LUNG JONG	HUAI SA-BAEK
WATERSHED AREA (SQ. KM)	51	60
VARIABLE AREA (SQ. KM)	2,240	2,021
RESERVOIR AREA (SQ. KM)	17.5	28.8
LENGTH OF DAM (M)	2,030	1,937
WIDTH OF CREST (M)	6.0	9.0
MAX WATER DEPTH (M)	18.50	19.0
OUTLET (CM)	2.0	4.15
CANAL (CM)	2 CANALS 48	2 CANALS 41.4
PROJECT COST (M. BAHT)	120	130
CONSTRUCTION TERM	1987-1990	1987-1991

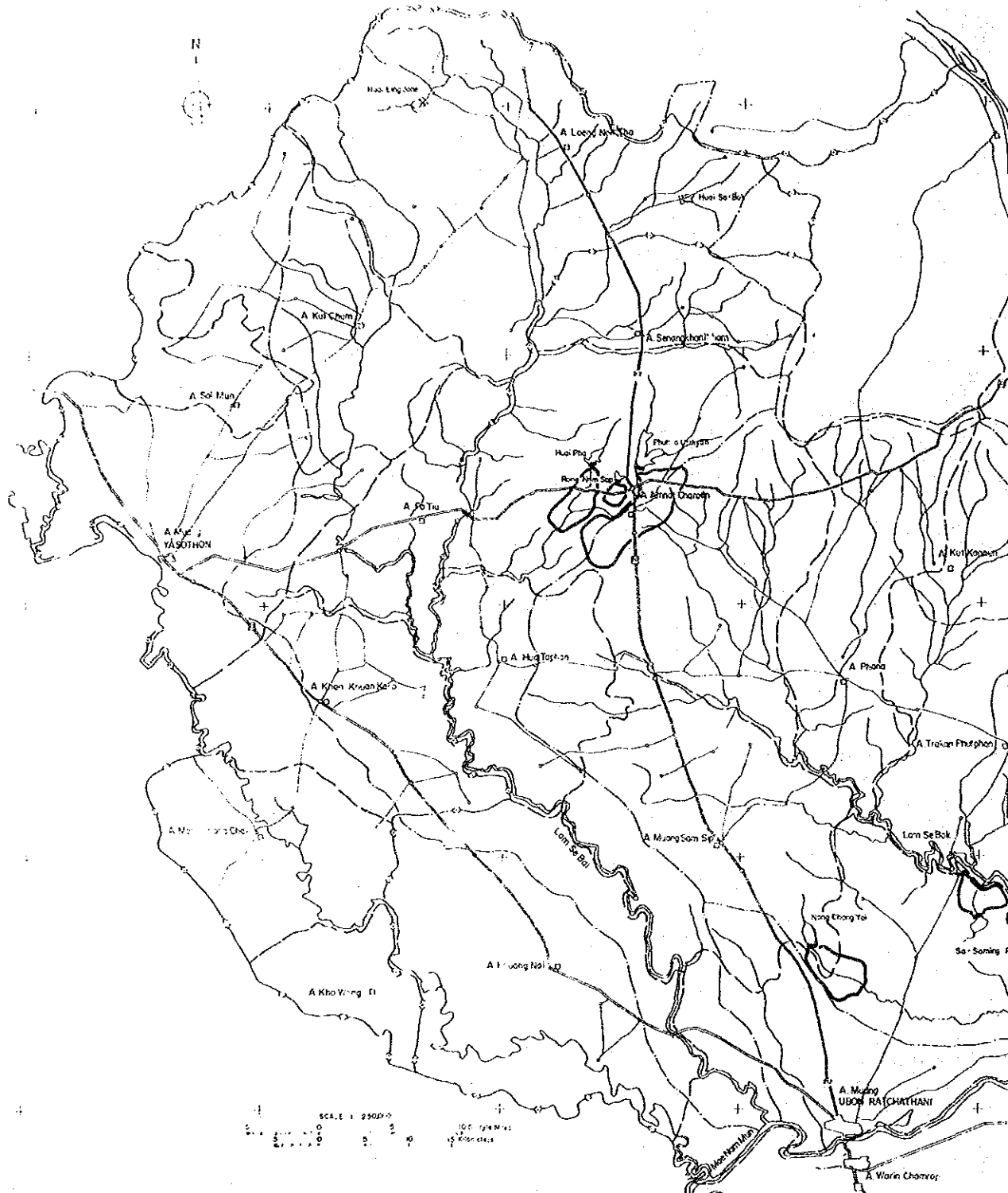


TYPICAL CROSS SECTION OF MAIN IRRIGATION CANAL



THE FEASIBILITY STUDY OF SEBAI-SITJOK BASIN DEVELOPMENT PROJECT IN THE NORTHEAST REGION (RID)

EXISTING AND UNDER-STUDY PROJECTS

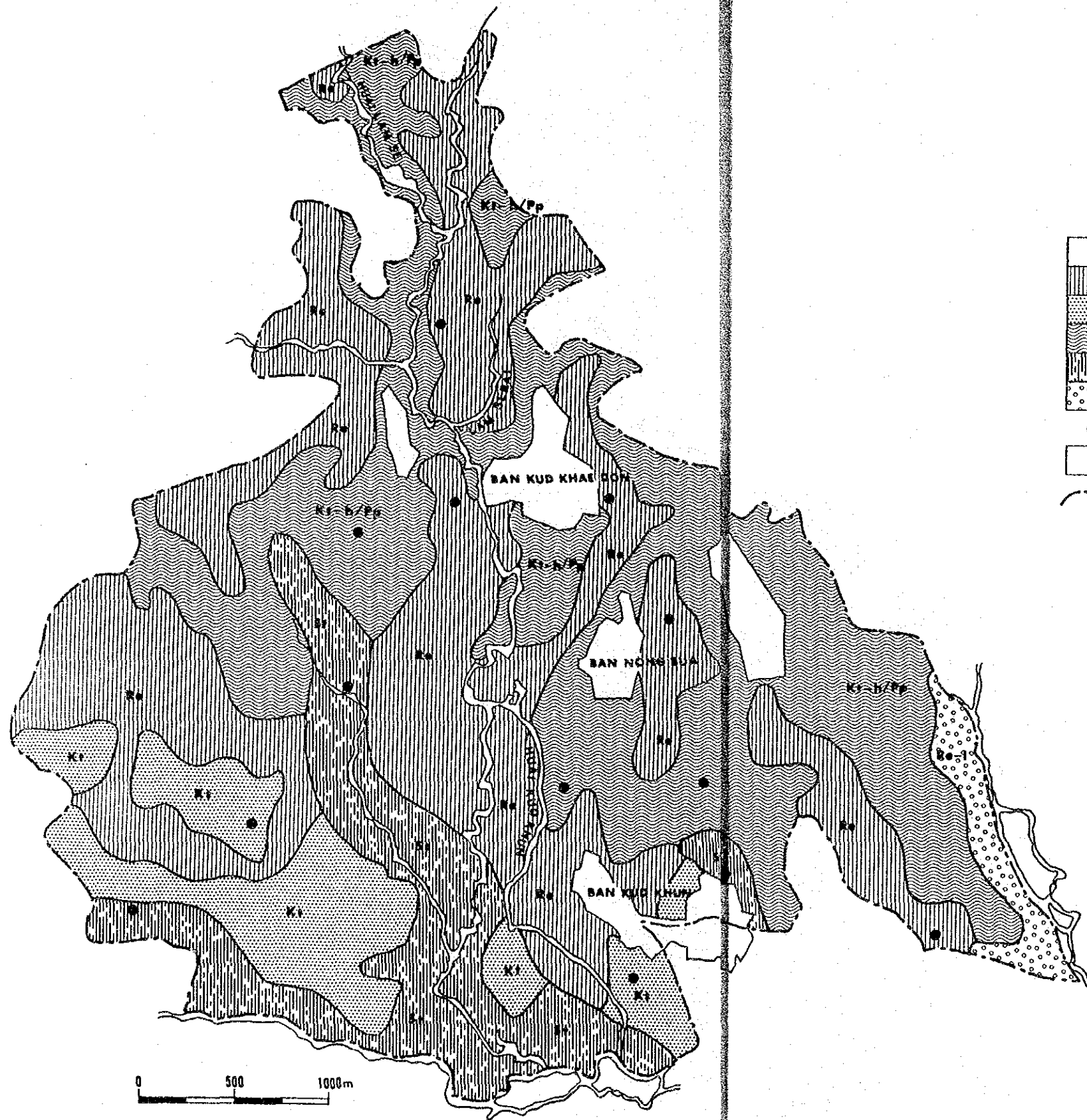
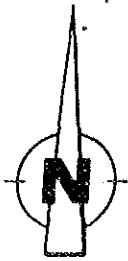


EXISTING DAM






DIMENSION	HUAI PHO	PHONG NAM SAP	PHUTTHA UTTHAYAN	PHONG CHONG YAI	SA-SAM-INS	HUAI THAMMAHEE
DAM TYPE	EARTH DAM	EARTH DAM	EARTH DAM	ESATH DAM	ESATH DAM	STONE TYPE DAM
RESERVOIR CAPACITY (CMH)	5 392	0 425	13 339	1 011	7 681	18 506
LENGTH OF DAM (M)	510	780	1,300	350	640	1 826
HEIGHT OF DAM (M)	6.0	5.0	15.5	4.5	5.5	18.5
WATERSHED AREA (SQ. KM)	17	1.7	62	2	62	52
VARIABLE AREA (SQ. KM)	720	67	2,565	120	1,200	1,680
OUTLET (CM)	1 213	0 032	2 477	0 081	5 78	8 70
CANAL (CM)	2800 17.9	1800 1.7	2800 21.3	1800 1.2	2800 1.1	2800 18.0
CONSTRUCTION TERM	1953-1956	1952-1956	1957-1983	1953-1954	1953-1953	1988-1988




MAIN IRRIGATION CANAL PHUTTHA UTTHAYAN PROJECT

FEASIBILITY STUDY FOR FIVE PROJECTS



LEGEND

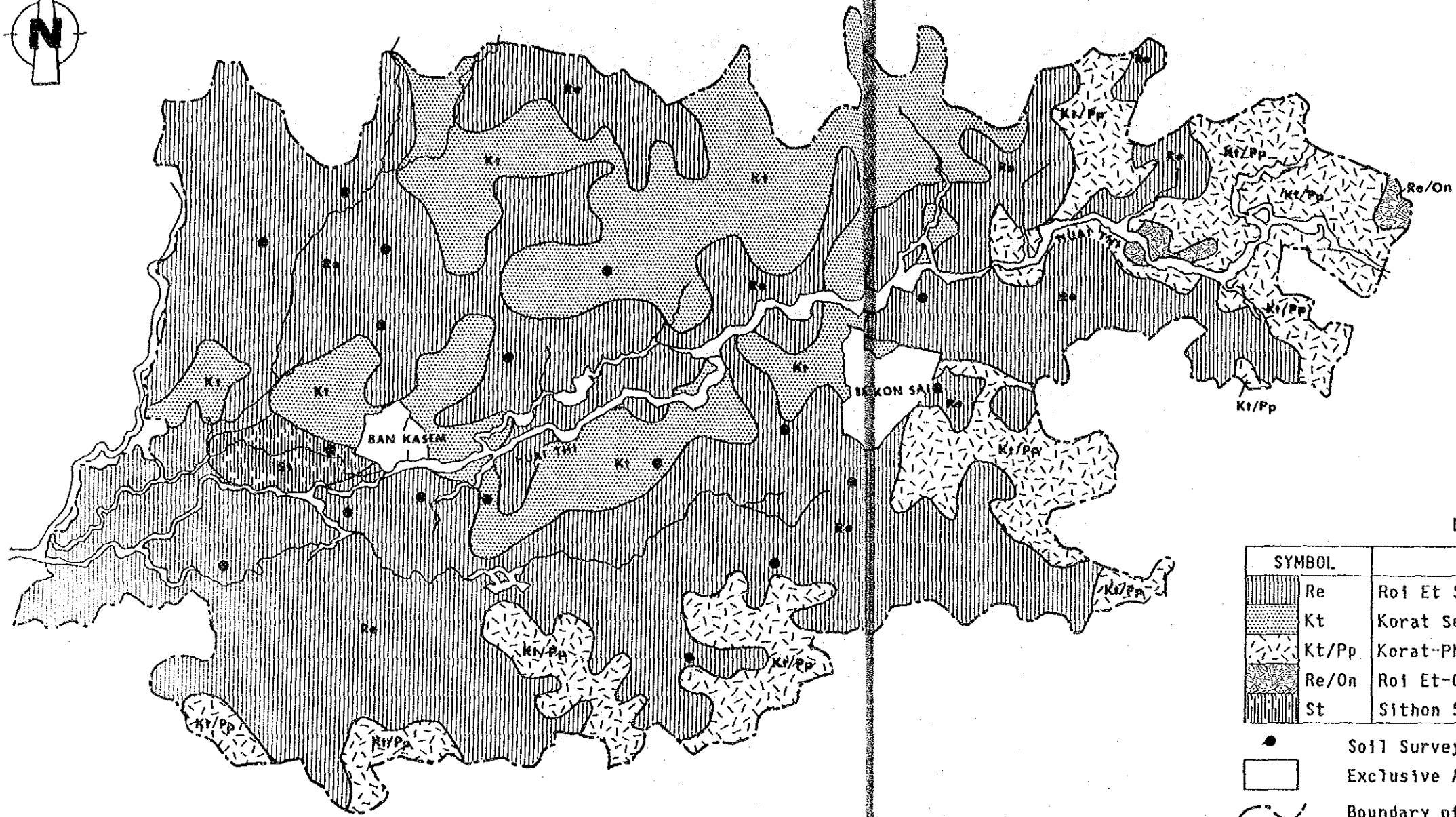
SYMBOL	SOIL NAME
	Re Roi Et Series
	Kt Korat Series
	Kt-h/Pp Korat, high-Phon Phi Sai Association
	St Sithon Series
	Re-1 Roi Et, loamy

-  Soil Survey Point (by Soil auger boring)
-  Exclusive Area
-  Boundary of Project Area






THE FEASIBILITY STUDY OF
SEBAI-SEBOK BASIN DEVELOPMENT PROJECT
IN THE NORTHEAST REGION (RI0)




SOIL CLASSIFICATION (1/5)

LAM SE



LEGEND

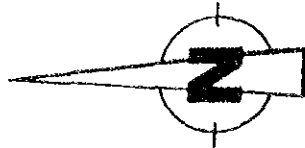
SYMBOL	SOIL NAME
	Re Roi Et Series
	Kt Korat Series
	Kt/Pp Korat-Phon Phi Sai Association
	Re/On Roi Et-On Association
	St Sithon Series

-  Soil Survey Point (by Soil auger boring)
-  Exclusive Area
-  Boundary of Project Area



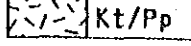
THE FEASIBILITY STUDY OF
SEBAI-SEBOK BASIN DEVELOPMENT PROJECT
IN THE NORTHEAST REGION (RID)




SOIL CLASSIFICATION (2/5)

HUAI KHUM KHAM



LEGEND

SYMBOL	SOIL NAME
	Re Roi Et Series
	Re/On Roi Et-On Association
	Kt/Pp Korat-Phon Phi Sai Association

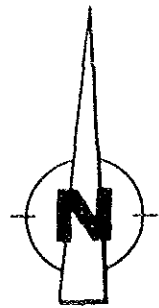
-  Soil Survey Point (by Soil auger boring)
-  Exclusive Area
-  Boundary of Project Area






THE FEASIBILITY STUDY OF
SEBAI-SEBOK BASIN DEVELOPMENT PROJECT
IN THE NORTHEAST REGION (RID)




SOIL CLASSIFICATION (3/5)

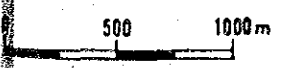
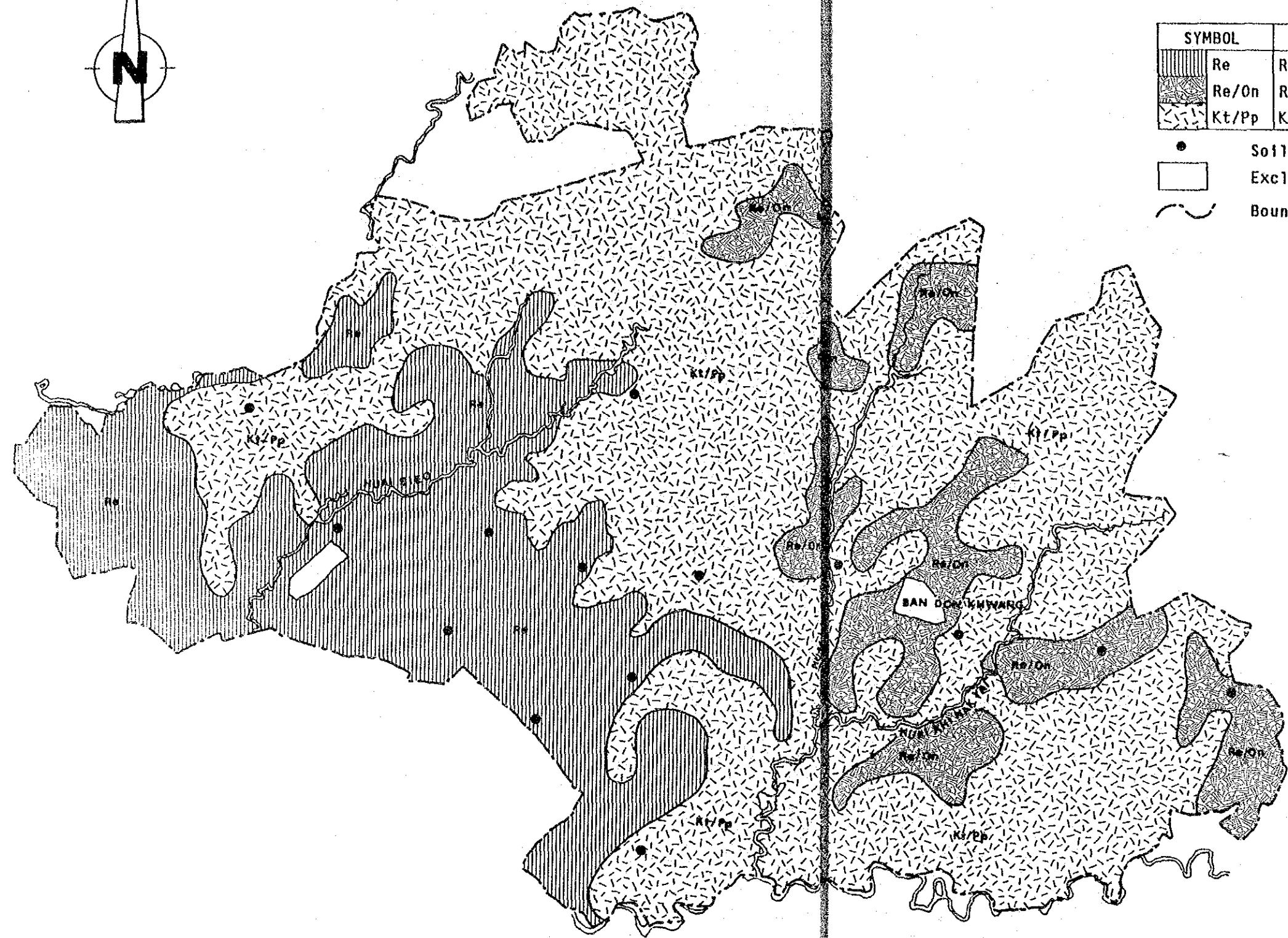
HUAI KHAM PHAK WAN



LEGEND

SYMBOL	SOIL NAME
 Re	Rot Et Series
 Re/On	Rot Et-On Association
 Kt/Pp	Korat-Phon Phi Sai Association

-  Soil Survey Point (by Soil auger boring)
-  Exclusive Area
-  Boundary of Project Area

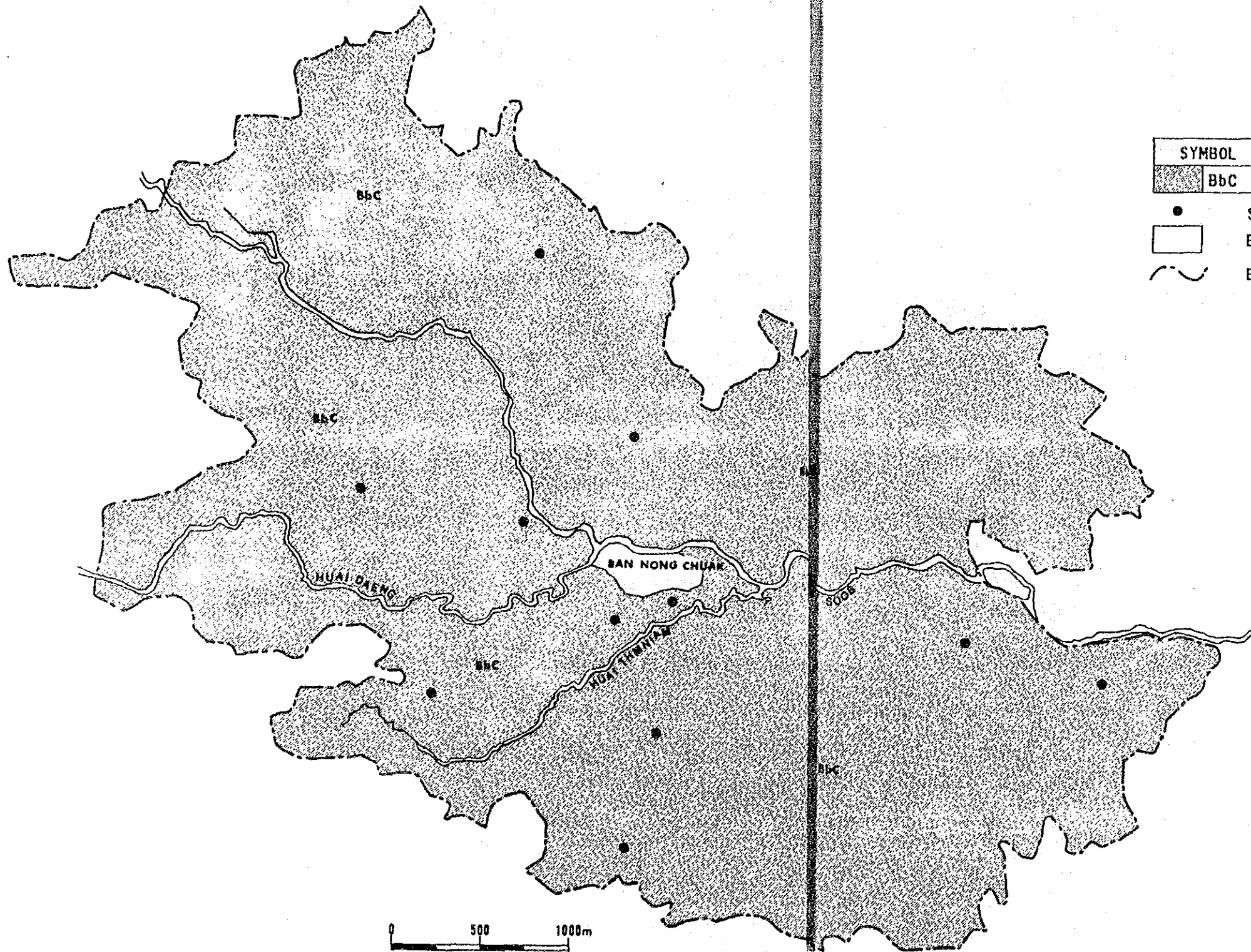
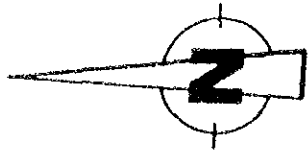


THE FEASIBILITY STUDY OF
 SEBAI-SEBOK BASIN DEVELOPMENT PROJECT
 IN THE NORTHEAST REGION (RII)

SOIL CLASSIFICATION (4/5)




HUAI NA KHAI

NO. F-4 JAPAN INTERNATIONAL COOPERATION AGENCY



LEGEND

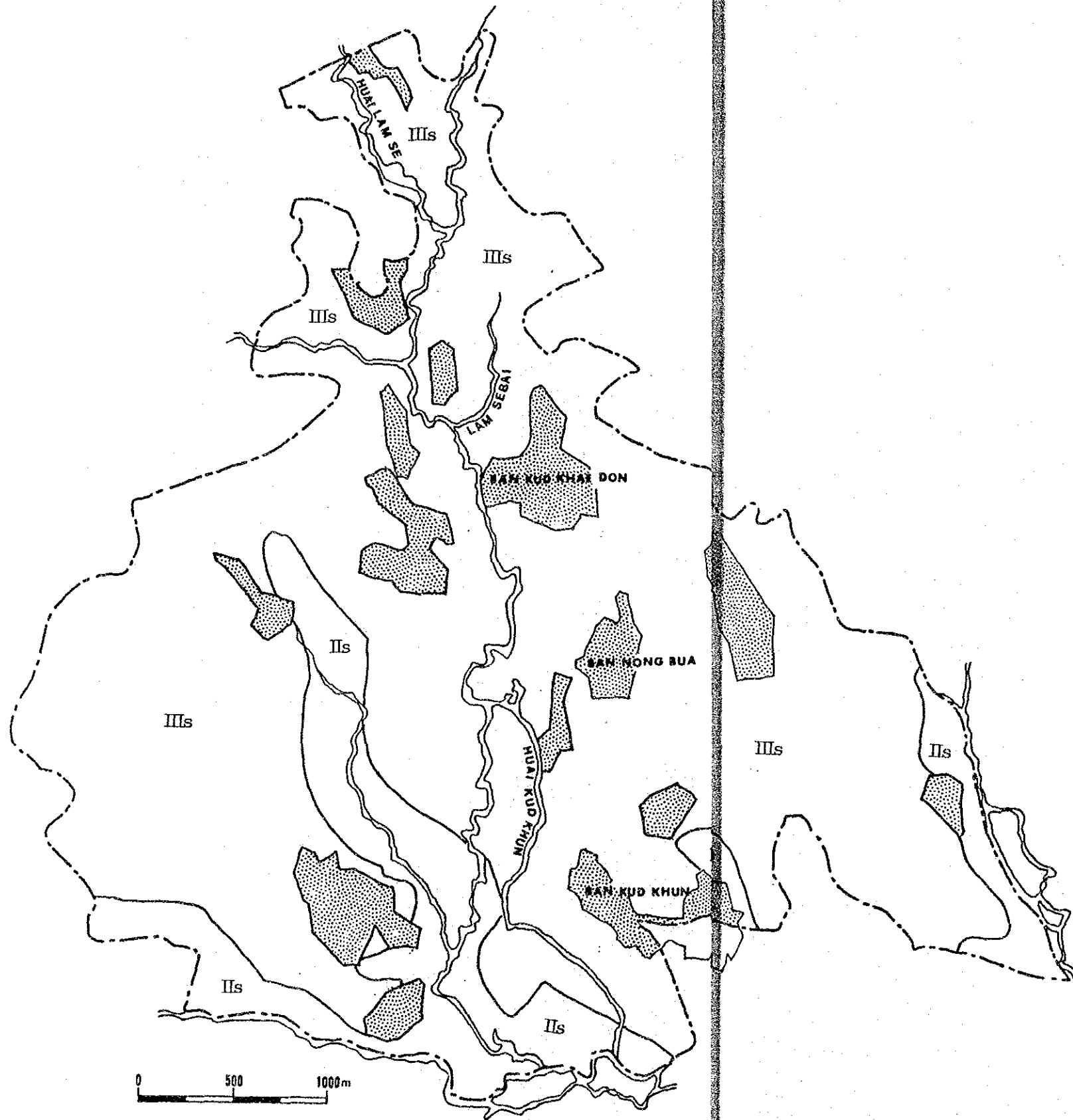
SYMBOL	SOIL NAME
 BbC	Borabu Complex

-  Soil Survey Point (by Soil auger boring)
-  Exclusive Area
-  Boundary of Project Area

THE FEASIBILITY STUDY OF
SEBAI-SEBOK BASIN DEVELOPMENT PROJECT
IN THE NORTHEAST REGION (RID)

SOIL CLASSIFICATION (5/5)

HUAI SOOB



LEGEND

Class	Suitability for Paddy Rice
II s	well
III s	moderately



Exclusive Area



Boundary of Project Area

Note : II s and III s mean some soil problems exist in class II and III.

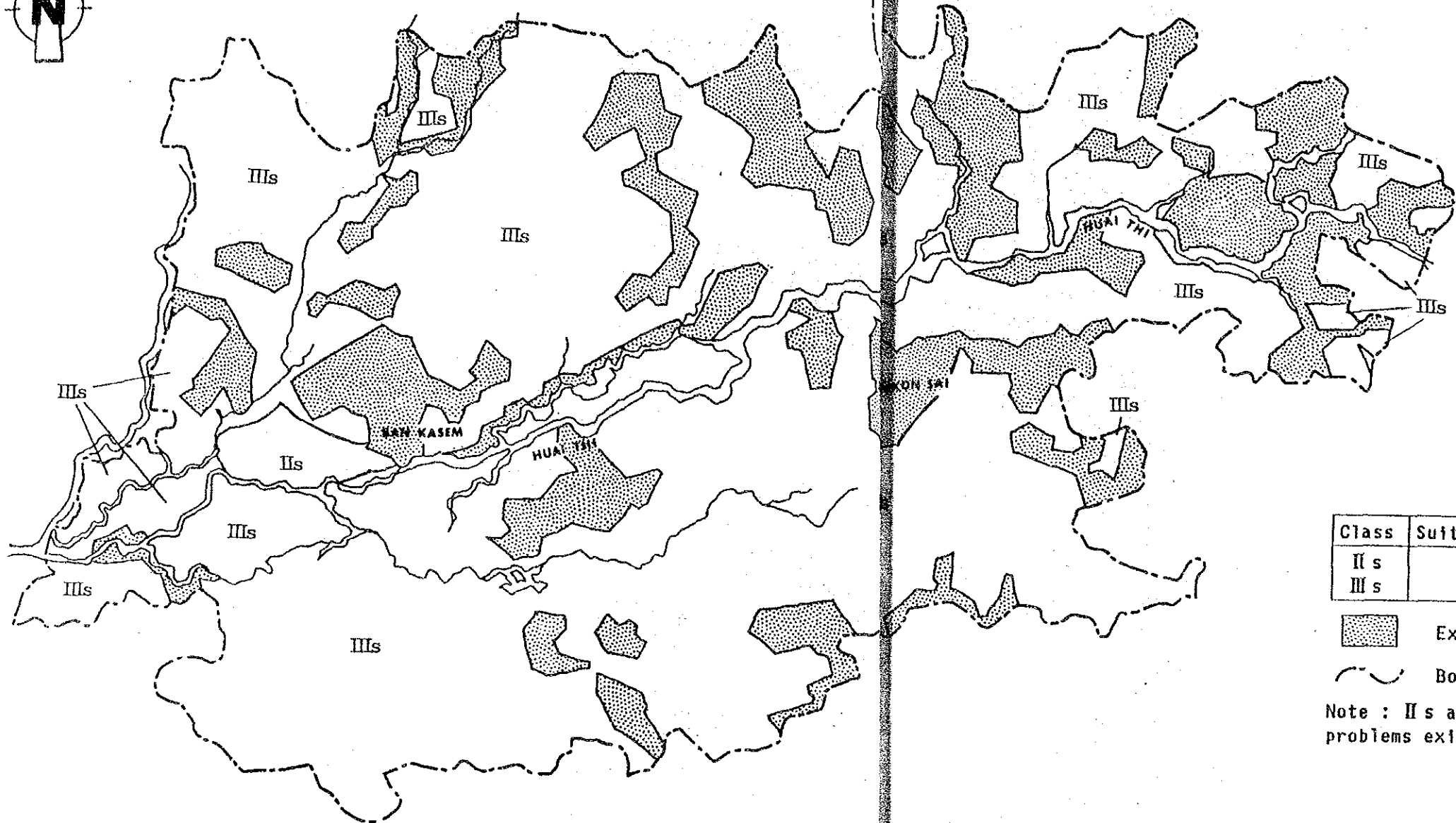
THE FEASIBILITY STUDY OF
SEBAI-SEBOK BASIN DEVELOPMENT PROJECT
IN THE NORTHEAST REGION (RID 1)

LAND CLASSIFICATION (1/5)

LAM SE



NO. F-6

JAPAN INTERNATIONAL COOPERATION AGENCY



LEGEND

Class	Suitability for Paddy Rice
II s	well
III s	moderately

-  Exclusive Area
-  Boundary of Project Area

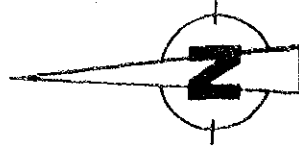
Note : II s and III s mean some soil problems exist in class II and III.

THE FEASIBILITY STUDY OF
SEBAI-SEBOK BASIN DEVELOPMENT PROJECT
IN THE NORTHEAST REGION (RIID)

LAND CLASSIFICATION (2/5)


HUAI KHUM KHAM


NO F-7 JAPAN INTERNATIONAL COOPERATION AGENCY



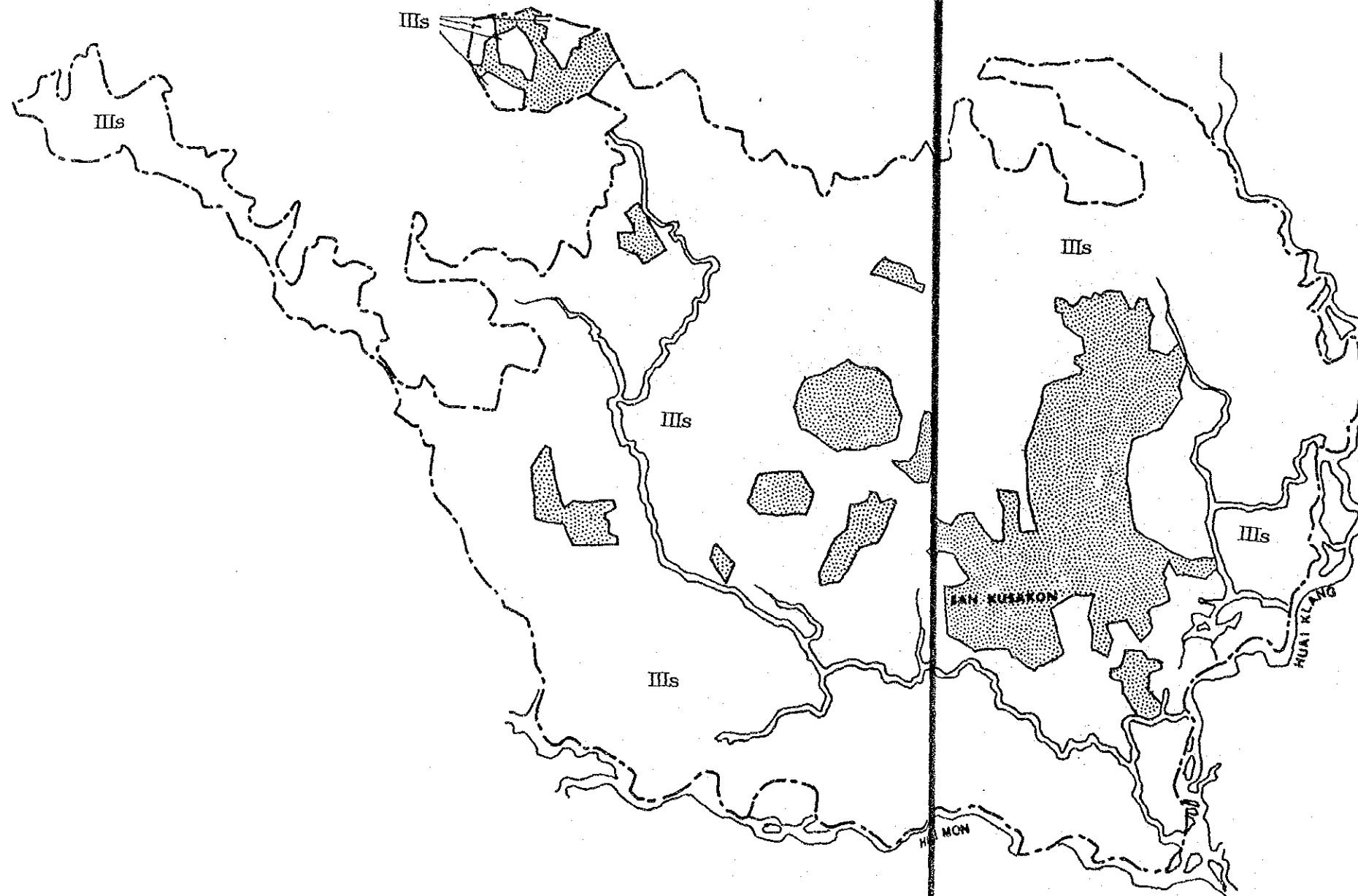
LEGEND

Class	Suitability for Paddy Rice
III s	moderately

 Exclusive Area

 Boundary of Project Area

Note : III s means some soil problems exist in class III.



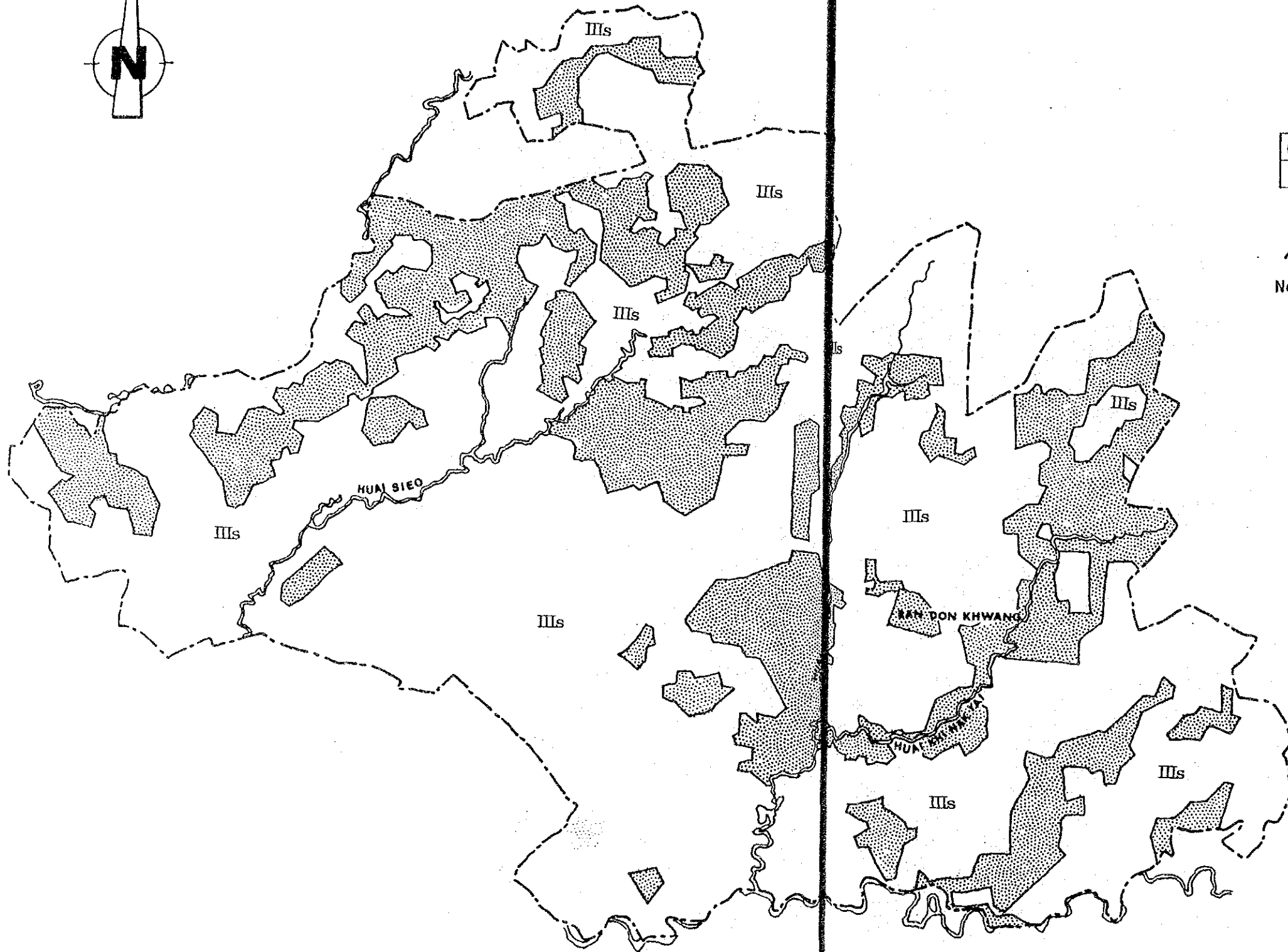
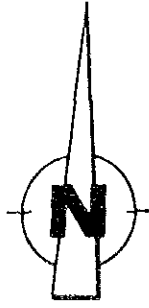
0 500 1000m

THE FEASIBILITY STUDY OF
SEBAI-SEBOK BASIN DEVELOPMENT PROJECT
IN THE NORTHEAST REGION (RID)

LAND CLASSIFICATION (3/5)


HUAI KHAM PHAK WAN


NO F-8 JAPAN INTERNATIONAL COOPERATION AGENCY



LEGEND

Class	Suitability for Paddy Rice
III s	moderately

 Exclusive Area

 Boundary of Project Area

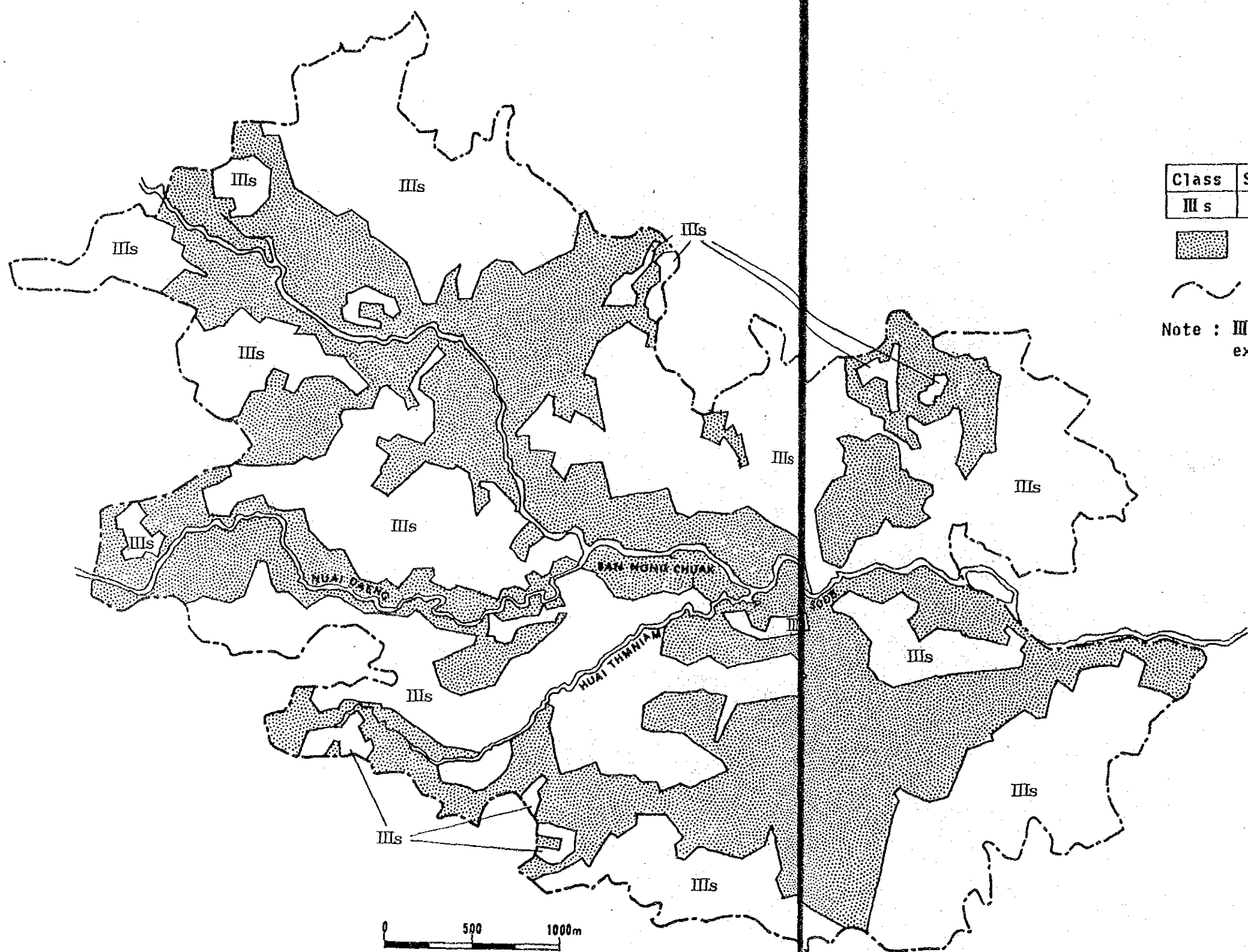
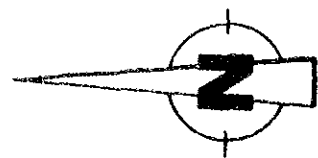
Note : III s means some soil problems exist in class III.



THE FEASIBILITY STUDY OF
SEBAI-SEBOK BASIN DEVELOPMENT PROJECT
IN THE NORTHEAST REGION (R10)

LAND CLASSIFICATION (4/5)

HUAI NA KHAI



LEGEND

Class	Suitability for Paddy Rice
III s	moderately



Exclusive Area



Boundary of Project Area

Note : III s means some soil problems exist in class III.

THE FEASIBILITY STUDY OF
SEBAI-SEBOK BASIN DEVELOPMENT PROJECT
IN THE NORTHEAST REGION (RUD)

LAND CLASSIFICATION (5/5)

HUAI SOOB