

表-1 作業監理委員及び調査業務従事者リスト

Name	Position
JICA Advisory Committee	
Mr. Takeshi ISHIDA	Chairman of the Committee (1st Stage)
Mr. Kazuo KIMURA	Chairman of the Committee (2nd Stage)
Mr. Tadayoshi TOKO	Advisor on Agriculture
Dr. Teruyuki NISHIJIMA	Advisor on Geology & Groundwater
Mr. Shigeaki UCHIMURA	Advisor on Irr. & Drainage
Mr. Masami MIZUNO	Advisor on Project Economy
Mr. Takashi SHINO	Coordinator
Mr. Hidero OSAWA	Coordinator
JICA Study Team	
Mr. Masashi SHONO	Team Leader
Mr. Seiji KOYANAGI	Irrig. & Drainage Engineer
Mr. Shozo INOUE	Design Engineer
Mr. Ryuji ICHINOSE	Mechanical Engineer
Mr. Masao HIGUCHI	Hydrologist
Mr. Hiroshi TANAKA	Mini-hydropower Engineer
Mr. Kuninobu NODA	Water Management Expert
Mr. Kenjiro ONAKA	System Management Engineer
Mr. Yojiro SEKIGUCHI	Agronomist
Ms. Mihoko URAMOTO	Agro-economist
Counterpart Group	
Mr. Leonardo E. Balite	Chief Counterpart
Mr. Reinecio E. Irinco	Irrig. & Drainage Engineer
Mr. Virgilio S. Miguel	Irrig. & Drainage Engineer
Mr. Othelo L. Razon	Irrig. & Drainage Engineer
Mr. Gregorio S. Dumandan	Mechanical Engineer
Mr. Theodore C. Calma	Hydrologist
Mr. Vicente C. Tolentino	Mini-hydropower Engineer
Mr. Vicente E. Santos, Jr.	Inst./Water Regulation Expert
Mr. Jose F. Mallari	Water Management Expert
Mr. Felimon C. Montano	Farmer's Association Expert
Mr. Enrique A. Sabio, Jr.	Farmer's Association Expert
Mr. Herminigildo S. Tabares	Soil/Land Use Expert
Mr. Guillermo C. de Guzman	Agronomist
Mr. Carlito D. Herrera	Agronomist
Mr. Jose R. Castillo	Agro-economist
Mr. Candido L. Raquepo	Agro-economist

表-2 ポンプ灌漑システムの現況

Name of Systems	Generated Service Area (ha)		No. of Farmers in Service Area		No. of Farmers in Irrigation Area		No. of Farmers in Service Area		Irrigation Facilities		Pump Facilities		Length of Drainage Canal (km)		Irrigated Area 1987 (ha)		Annual Irrig. Water Supplied by Pumps in '87 (million m <sup>3</sup> /year)		Estimated Water Consumption (mm/day)		
	Area	No. of Farmers	Area	No. of Farmers	Area	No. of Farmers	Area	No. of Farmers	Length of Canal (km)	No. of Units	Design Capacity (m <sup>3</sup> /m)	Actual Capacity (m <sup>3</sup> /m)	Source	Power Rate (kwh/m <sup>3</sup> )	Wet	Dry	Wet	Dry			
1. Bonga Pump #1	425	298	2,430	1,420	2,030	0.21	3.38	5.08	102	-	1975	2	75.7	32.7	INECO(2)	2.17	0	165	57	2.5	9.4
2. Bonga Pump #2	-	674	5,900	1,361	382	0.27	14.16	21.80	382	21.82	1975	3	208.2	107.7	INECO	2.14	0	375	208	5.2	7.4
3. Bonga Pump #3	216	702	1,660	420	450	0.48	4.75	3.32	91	68.1	1975	2	68.1	31.0	INECO	2.17	0	140	62	2.6	10.5
4. Alcala/Amilung	2,350	1,840	-	2,190	2,800	0.84	9.87	21.96	140	18.15	1982	4	291.5	(6) NAYCOOR (4)	1.40	45.86	1,030	996	28.3	21.5	
5. Solana	2,865	1,320	1,890	1,250	2,700	1.06	18.36	25.62	181	32.86	1975	4	408.8	163.7	CAGELCO(3)	1.90	19.10	847	0	12.8	12.6
6. Libmanan Cabuao	4,102	2,195	1,880	1,050	1,980	2.09	11.17	52.99	297	40.50	1973	4	366.4	172.9	CR SUR 1 ELEC. COOP. (5)	2.10	56.75	1,118	0	8.3	6.2

Name of Systems	Irrigation Fee Base PER Ha		Collected Irrigation Fee Amount		Efficiency of Irrigation Fee Collection		Total O&M Cost in '87		Balance of O&M Cost		Unit O&M Cost		Major Cropping Pattern		Cropping Intensity		Unit Yield of Paddy		Farm Income in Service Area		Gross Domestic Product per Capita (P250)
	Wet Season (Cayan)	Dry Season (Cayan)	In '87 (1,000 Pesos)	In '87 (1,000 Pesos)	In '87 (%)	In '87 (%)	Total O&M Cost (1,000 Pesos)	Minus O&M Cost (1,000 Pesos)	Per Ha O&M Cost (1,000 Pesos)	Per Ha O&M Cost (1,000 Pesos)	Wet	Dry	Wet	Dry	Area of Area (ha)	Area of Area (ha)	Wet Season	Dry Season	Income (pesos/ha)	Area (hectares)	
1. Bonga Pump #1	8.0	12.0	233	329	83	83	75	-246	2,385	238	-	-	Paddy	Paddy or Div. Crop	117	187	3.3	3.5	2.3	2,100	6,970
2. Bonga Pump #2	9.0	12.0	509	790	60	60	79	-281	1,355	674	-	-	Paddy	Paddy or Div. Crop	108	161	3.5	4.0	2.4	3,650	6,970
3. Bonga Pump #3	8.0	12.0	100	313	32	32	59	-213	1,547	202	-	-	Paddy	Paddy or Div. Crop	101	142	3.8	4.1	2.3	7,040	6,970
4. Alcala/Amilung	7.5	7.5	1,572	2,450	83	83	62	-877	1,209	660	6.6	6.6	Paddy	Paddy or Fallow	96	-	3.3	3.5	1.8	7,560	7,055
5. Solana	14.0	14.0	11,659	2,227	60	60	78	-1,061	2,629	-	-	-	Paddy	Paddy or Fallow	45	60	3.1	3.3	2.8	13,700	7,055
6. Libmanan Cabuao	6.0	6.0	182	667	16	16	55	-485	597	1,098	-	-	Paddy	Paddy or Fallow	60	117	2.8	3.3	2.0	9,330	5,292

Remarks: (1): Service area/No. of farmers in the service area (2): Ilocos Norte Electric Cooperative Inc.  
 (4): National Power Corporation (5): Camarines Sur 1 Electric Cooperative Inc.  
 (7): Water master (8): Ditch tender  
 (9): Annual benefited area/higher value of the irrigated area within wet and dry seasons in 1986  
 (3): Cagayan Electric Cooperative Inc.  
 (6): Actual discharge capacity was not measured

表-3 ポンプ灌漑システム改善の必要性

Name of Pumping System	Rehabilitation of Irrigation/Drainage Facilities		Pump Equip-ment		Electric Equip-ment		Trans-mission Line		Direct Power Supply from NPC		Supply of O&M Equip-ment		Increase of Nos. of Staff		Reinforce-ment and Improvement of Monitoring System		Reinforce-ment of Commu-nication System		Special Training of Farmers OM Staff		
	Canal System	On-farm Facility	Equip-ment	Equip-ment	Equip-ment	Equip-ment	Equip-ment	Equip-ment	Equip-ment	Equip-ment	Equip-ment	Equip-ment	Equip-ment	Equip-ment	Equip-ment	Equip-ment	Equip-ment	Equip-ment	Equip-ment	Equip-ment	Equip-ment
1. Bonga Pump #1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2. Bonga Pump #2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3. Bonga Pump #3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4. Alcala-Amulung	0	0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
5. Solana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6. Libmanan-Cabusao	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Remarks: O: Improvement or reinforcement is needed.  
X: No improvement is needed.

表-4 ポンプ灌漑システムの改修・改善計画

Name of System	Replacement of Pumping Facilities		Power Supply System		Irrigation Canal		Irrigation Facilities		Drainage Facilities		Service Road		On-Farm Facilities					
	Pump Capacity (Unit)	Pump Unit (m3/m)	Sub-station (kVA)	Trans-line (km)	Irrigation Canal Rehab. (km)	New Replacem. (km)	Turnout (nos.)	Turnout (nos.)	Rehab. (km)	New Flaggate (nos.)	Replacem. (km)	Other (nos.)	Improve-ment (km)	New Road (km)	New Farm Drain (km)			
(I) Direct Tapping																		
Bonga Pump #1	2	35.1	2	Tripartite*	5000 *	8.8 *	5.4	0.0	31	2	2	0.0	9.0	0	2.4	0.8	12.9	28.8
Bonga Pump #2	3	37.0	3	Tripartite*			6.2	0.0	24	0	0	0.0	14.6	0	0.0	0.0	19.6	47.2
Bonga Pump #3	2	15.9	2	Tripartite*			4.0	0.3	41	0	0	0.0	4.5	0	0.0	1.0	0.0	14.1
Alcala-Amulung	0	-	0	**	**	**	27.8	0.0	6	7	0	12.7	1.1	0	0.0	0.0	31.3	133.7
Solana	4	82.1	4	direct NIA-NPC	1750	0.2	16.5	0.0	38	25	2	18.5	0.0	0	0.0	0.0	92.0	176.3
Libmanan Cabusao	0	-	0	Tripartite	5000	0	32.4	1.9	45	9	7	44.6	0.0	9	6.3	10.4	20.9	171.6
(II) Indirect Tapping																		
Bonga Pump #1	2	35.1	2				5.4	0.0	31	2	1	0.0	9.0	0	2.4	0.8	12.9	28.8
Bonga Pump #2	3	37.0	3				6.2	0.0	24	0	0	0.0	14.6	0	0.0	0.0	19.6	47.2
Bonga Pump #3	2	15.9	2				4.0	0.3	41	0	0	0.0	4.5	0	0.0	1.0	0.0	14.1
Alcala-Amulung	0	-	0				27.8	0.0	6	7	0	12.7	1.1	0	0.0	0.0	31.3	133.7
Solana	4	82.1	4				16.5	0.0	38	25	2	18.5	0.0	0	0.0	0.0	92.0	176.3
Libmanan Cabusao	0	-	0				32.4	1.9	45	9	7	44.6	0.0	9	6.3	10.4	20.9	171.6

Remarks: \* Power supply system would be shared by Bonga Pump #1, #2, and #3.  
\*\* Power for the Alcala-Amulung pump station is being supplied directly from NAPOCOR.

表-5 維持管理施設の強化計画

Item	Unit	Bonga #1 Bonga #2 Bonga #3	Alcala- Amulung	Solana	Libmanan- Cabusao
<b>I. O &amp; M Equipment</b>					
<b>1. Heavy Equipment</b>					
1. Backhoe-Crawler, 0.4cum	unit	1	0	1	1
2. Loader with Backhoe Wheeled, 0.5cum	unit	1	1	0	0
3. Dump Truck, 6t	unit	0	0	1	1
4. Spare Parts *	L.S.	1	1	1	1
<b>2. Light Equipment</b>					
1. Pick-up, 3/4 ton	unit	1	1	1	0
2. Cargo Truck, 6 ton	unit	1	1	1	0
3. Motorcycle	unit	9	19	8	12
4. Spare Parts *	L.S.	1	1	1	1
<b>3. Miscellaneous Equipment</b>					
1. Portable Compactor	unit	1	1	1	1
2. Centrifugal Pump, 100mm	set	1	1	1	1
3. Sand Pump, 100mm	set	1	1	1	1
3. Chain Block, 5 ton	unit	3	2	2	2
5. Maintenance Tools	set	1	1	1	1
6. Measurement Instrument	set	1	1	1	1
7. Spare Parts	L.S.	1	1	1	1
<b>II. Monitoring Facilities</b>					
1. Rain Gage (Standard Type)	nos	0	0	0	0
2. Staff Gage	nos	20	18	11	32
<b>III. Communication Facilities</b>					
1. Radio set	set	0	0	0	1
2. spare Parts	L.S.	0	0	0	1

Remark; \* = Spareparts for the proposed and existing equipment.

表-6 ウォーターマスターに対する標準研修課程概要

Goal of Training	Training Item	Aims	Contents	Training Method
1. training orientation				lecture/discussion workshop
2. to acquire knowledge of the irrigation plan	on-farm irrigation requirement	to understand approx. amount, constituent factors, seasonal variation of water requirement for paddy and diversified crops	<ul style="list-style-type: none"> <li>- registration</li> <li>- raising of expectations</li> <li>- evapotranspiration</li> <li>- percolation</li> <li>- effective rainfall</li> <li>- irrigation efficiency</li> <li>- rotational irrigation and simultaneous irrigation</li> </ul>	<ul style="list-style-type: none"> <li>-do-</li> <li>-do-</li> <li>-do-</li> <li>-do-</li> <li>-do-</li> <li>-do-</li> <li>-do-</li> </ul>
	irrigation requirements for tertiary block, major diversion structure and pump	to understand irrigation method such as rotational and simultaneous irrigation	<ul style="list-style-type: none"> <li>- farming practice and irrigation method</li> <li>- seasonal diversion requirements</li> <li>- general climate</li> <li>- rainfall/available water sources</li> <li>- water balance in the river system</li> <li>- data bank system</li> </ul>	<ul style="list-style-type: none"> <li>-do-</li> <li>-do-</li> <li>-do-</li> <li>-do-</li> <li>-do-</li> <li>-do-</li> </ul>
	hydrology	to understand available water sources of the river		
	kind and function of irrigation facilities	to understand water balance in the river system		
3. to acquire knowledge of facilities	kind and function of irrigation facilities	to gain knowledge about the kind and function of irrigation facilities		lecture
	operation method of water management facilities	to learn how to measure discharge to learn how to operate water management facilities	<ul style="list-style-type: none"> <li>- design criteria for canal and canal</li> <li>- hydraulic features of structures</li> <li>- movable structures such as gate and check structures</li> </ul>	<ul style="list-style-type: none"> <li>-do-</li> <li>-do-</li> <li>-do-</li> </ul>
	organizational structure, function and responsibilities	to obtain knowledge about organizational structure and function		lecture
	procedure for water management	to make clear the responsibilities of water master at various level of management		-do-
	reporting system	to obtain knowledge about administrative procedure to determine the irrigation plan to make clear reporting system		-do-
5. to learn procedures for water management and reporting system	procedure for water management	to obtain knowledge about monitoring and evaluation on water management		-do-
	reporting system	to obtain knowledge about monitoring and evaluation on economic benefit and evaluation on whole aspect related to maintenance of facilities		-do-
6. to acquire knowledge about monitoring and evaluation	monitoring on practice of water management	to understand an overall system management		-do-
	monitoring and evaluation	to evaluate effect of training		-do-
7. to acquire knowledge on maintenance of project facilities	maintenance of project facilities			lecture
	overall management			lecture, exercise
8. to acquire knowledge on the overall management of the irrigation system	overall management			lecture
9. to evaluate effect of training	overall management			lecture

表-7 デイチタンダーに対する標準研修課程概要

Goal of Training	Training Item	Aims	Contents	Training Method
1. training orientation			- registration - raising of expectation	lecture/workshop -do-
2. to acquire knowledge of kind and function of facilities operation method of water management facilities		to gain knowledge about function of irrigation facilities to learn how to measure discharge and climate data to learn how to operate water management facilities	- hydraulic features of structures - measuring rainfall, evaporation, temperature, discharge, etc. - operation rule of water management facilities	lecture/field practice -do- -do-
3. to acquire knowledge about organization and responsibilities		to obtain knowledge about organizational structure and function to make clear the responsibilities of ditchtender at various level of management	- organization of the IA - organization of NIA - other organization - responsibilities of ditchtender	lecture -do- -do- -do-
4. to learn procedures for water management and reporting system		to obtain knowledge about procedure for determination of the irrigation plan to make clear reporting system	- determination of annual irrigation plan - reporting system for water management - form of report/communication	-do- -do-
5. to acquire knowledge on maintenance of facilities		to understand the whole aspect of maintenance	- maintenance system	lecture
6. to acquire knowledge of overall management of the irrigation system		to understand the overall system of management	- system management	field visit/lecture
7. to evaluate effect of training		to evaluate effect of training	- evaluation	lecture/exercise

表-8 ポンプオペレーターに対する標準研修課程概要

Goal of Training	Training Item	Aims	Contents	Training Method
1. training orientation			- registration - raising of expectation	lecture/workshop -do-
2. to acquire with irrigation plan	on-farm irrigation requirement	to develop understanding the role of pump facilities on irrigation system	- role of pump facilities	lecture/workshop
3. to learn basic knowledge on pump facilities	basic electrical knowledge	to develop basic electrical knowledge about pump facilities	- principle of electricity - function of sub-station, transformer, pump panel, motor - pump starting methods	-do- -do- -do-
		to develop basic mechanical knowledge of pump facilities	- naming of parts and devices in pump equipment - mechanical knowledge of pump equipment - function of pump equipment	-do- -do- -do-
4. to acquire operation method on pump equipment	direction and supervision of pump operation procedure for pump operation	to develop skill in direction and supervision of pump operation in system to develop skills in inspection of electrical and mechanical items and their operation	- direction and supervision - starting time, operating hours - operation manual of manufacturers - visual inspection - inspection of gages, vibration, temperature, oil level, leaks - inspection of intake, discharge channel - starting methods - check items in starting, during running	-do- -do- lecture/field practice -do- -do- -do- -do- -do-
	reporting and recording	to learn reporting & recording of pump operation for effective operation and maintenance	- purpose of reporting and recording - form for reporting and recording	-do- -do-
	safety work	to learn the safety work to prevent the labor accidents	- electric shock - mechanical accidents - case study	lecture -do- -do-
5. to acquire knowledge of maintenance work on pump facilities	maintenance	to learn how to maintain pump facilities	- daily, weekly, monthly maintenance - preventive maintenance - maintenance tools - replacement of spareparts	lecture/field practice -do- -do- -do-
6. to acquire knowledge overall management of the irrigation system	system management	to learn an overall system management	- system management	field visit/lecture
7. to evaluate effect of training		to evaluate effect of training	- evaluation	lecture/exercise

表-9 農民に対する標準研修課程概要 (指導)

Training Item	Aims	Contents	Training Method
1. training orientation		- registration - raising of expectation - training design orientation	lecture/workshop -do- -do-
2. NIA and institutional development programmes	to understand NIA organization	- NIA and its objectives, powers and structures - farmers participation - irrigation development - theoretical framework	lecture -do- -do- -do-
3. irrigation association	to understand farmers' organization	- farmers association - IA objectives, function and benefits - IA organizational structure - IA standards and indications	-do- -do- -do- -do-
4. leadership	to understand leadership	- leadership styles - IA leadership function and qualities - organizational discipline	-do- -do- -do-
5. basic knowledge and skills in IA leadership	to improve quality for leadership	- communication/group mobilization - problem solving/decision making - facilitating meeting - action reflection - roles and function of ICO/FID at different stages of IA development	-do- -do- -do- -do- -do-
6. training evaluation		- evaluation	lecture/exercise

表-10 農民に対する標準研修課程概要 (組織運営)

Training Item	Aims	Contents	Training Method
1. training orientation		- registration - levelling of expectation	lecture/workshop -do-
2. overview of irrigation system management	to understand an overall system management	- irrigation facilities - irrigation schedule (pre-, normal- and post-irrigation)	lecture -do-
3. operation method of water management on facilities	to learn how to measure discharge to learn how to operate water management of facilities	- measuring devices - operation rule of water management facilities - cropping pattern - water distribution plan	lecture/field practice -do- -do-
4. maintenance of facilities	to maintain project facilities	- maintenance system	lecture
5. monitoring system	to obtain knowledge of procedure of monitoring	- reporting system - form of reports/communication	-do- -do-
6. irrigation service fee collection	to collect fee efficiently	- procedure of fee collection - incentive of fee collection - fee collection plan	-do- -do- -do-
7. conflict of management	to solve conflict of water management	- sample exercise	lecture/exercise
8. organizational structure, function and responsibilities	to obtain knowledge about organizational structure and function to make clear the responsibilities of IA farmers and NIA staff	- organizations of IA and NIA - other organizations - responsibility of farmers and NIA staff	-do- -do- -do- -do-
9. training evaluation	to evaluate training	- training exercise	lecture/exercise



表-11 農民に対する標準研修課程概要 (財務)

Training Item	Aims	Contents	Training Methods
1. training orientation		- registration	lecture/workshop
2. theories and concept of financial management	to develop understanding of overall financial management	- raising of expectation	-do- lecture
		- concept of financial management tool	lecture
3. accounting	to simplify accounting system	- importance of financial management	-do-
		- component of IA-financial management	-do-
4. recording system	to understand recording system	- accounting as a financial management tool	-do-
		- function of accounting	-do-
5. book of accounts	to improve book of account	- simplified accounting form and use	-do-
		- recording of IA transaction	-do-
6. method of fee collection	to improve collection method	- book of accounts and use	-do-
		- accomplishment of each of book of accounts	-do-
7. reporting system	to understand and improve reporting systems	- steps in ISF collection	-do-
		- steps in ccash disbursement	-do-
8. NIA amortization scheme and financial planning	to understand amortization	- steps in auditing	-do-
		- systems and procedures in collection, cash disbursement and auditing	-do-
9. duties and responsibilities of IA personnel	to understand duties and responsibilities	- importance and components of financial report	-do-
		- preparation of cash statement	-do-
10. evaluation	to evaluate training	- preparation of balance sheet	-do-
		- concept of amortization	-do-
		- calculation of amortization	-do-
		- financial planning	-do-
		- responsibilities	-do-
		- training exercise	lecture/exercise

表-12 最適開発規模の検討

Item	Site No. 1				Site No. 2			
	Case 1	Case 2	Case 3	Case 4	Case 1	Case 2	Case 3	Case 4
Net Head (m)	22.1	22.1	22.1	22.1	8.55	8.55	8.55	8.55
Discharge (m <sup>3</sup> /s)	3.5	3.75	4.0	4.5	10.0	11.0	12.0	12.5
Output (kW)	612	656	700	787	642	706	770	802
Annual Energy (1,000 kWh)	4,284.16	4,402.44	4,510.80	4,642.56	4,487.04	4,790.16	5,061.67	5,092.92
Construction Cost* (1,000 US\$)	2,403.70	2,477.06	2,516.39	2,699.13	2,899.34	2,974.93	3,072.10	3,123.32
Cost per kWh (US\$)	0.561	0.563	0.558	0.581	0.646	0.621	0.607	0.613
Priority	2	3	1	4	4	3	1	2

Remark : \* = not including price contingency

表-13 小水力発電計画の施設概要

Items of Works	Unit	Site 1	Site 2	Combination
<b>1. Generating Equipment</b>				
a) Water turbine				
- Type		HF-1RS*	HF-1RS*	
- Effective head	m	22.1	8.55	
- Discharge	m <sup>3</sup> /s	4.0	12.0	
- Output	kw	736	845	
- Speed	rpm	600	165	
b) Generator				
- Output	kVA	778	855	
- Output	kW	700	770	
- Speed	rpm	600	900	
- Voltage	kV	3.3	3.3	
- Frequency	Hz	60	60	
- Increaser ratio		N/A	5.5	
- No. of poles		12	8	
<b>2. Substation &amp; Transmission Line</b>				
a) Transformer				
- Rated capacity	kVA	800	900	1600
- Rated frequency	Hz	60	60	60
- No. of phases		3	3	3
- Connection		Yd1 **	Yd1 **	Yd1 **
- Rated voltage 1st	kV	3.3	3.3	13.8
- Rated voltage 2nd	kV	13.8	13.8	69
- Tap voltage	kV	F14.5-F13.8- R13.2-F12.5- F12.0	F14.5-F13.8- R13.2-F12.5- F12.0	F72 -F69 - R66 -F63 - F60
b) Transmission line				
- 13.8 kV line	km			18.5

\* Horizontal shaft francis type one runner

\*\* Delta star connection

表-14 灌溉事業の事業費

(Unit: 1,000 Peso)

	Improvement of pump facilities including power supply system		Improvement of Irrigation & Drainage Facilities		Reinforcement of O&M Equipment		Improvement of Monitoring & Communication Facilities		Training Programme		Engineering and Administration		Sub Total		Physical Contingency		Grand Total		
<b>Direct tapping</b>																			
Bonga #1	13,117	4,549	1,914	0	412	19,992	2,997	22,989	2,299	25,288									
Bonga #2	17,293	3,614	3,014	0	484	24,405	3,662	28,067	2,807	30,874									
Bonga #3	7,966	2,494	877	0	27	11,364	1,704	13,068	1,307	14,375									
Alcala-Amulung	0	18,911	4,281	0	601	23,793	3,570	27,363	2,737	30,100									
Solana	32,096	22,568	5,516	0	394	60,574	9,086	69,660	6,967	76,627									
Libmanan-Cabusac	16,625	28,477	4,687	120	364	50,273	7,541	57,814	5,782	63,596									
<b>Total</b>	<b>87,097</b>	<b>80,613</b>	<b>20,289</b>	<b>120</b>	<b>2,282</b>	<b>190,401</b>	<b>28,560</b>	<b>218,961</b>	<b>21,899</b>	<b>240,860</b>									
<b>Indirect tapping</b>																			
Bonga #1	8,484	4,549	1,914	0	412	15,359	2,304	17,663	1,767	19,430									
Bonga #2	11,501	3,614	3,014	0	484	18,613	2,792	21,405	2,140	23,545									
Bonga #3	6,808	2,494	877	0	27	10,206	1,530	11,736	1,175	12,911									
Alcala-amulung	0	18,911	4,281	0	601	23,793	3,570	27,363	2,737	30,100									
Solana	25,798	22,568	5,516	0	394	54,276	8,140	62,416	6,242	68,658									
Libmanan-Cabusac	6,838	28,477	4,687	120	364	40,486	6,073	46,559	4,656	51,215									
<b>Total</b>	<b>59,429</b>	<b>80,613</b>	<b>20,289</b>	<b>120</b>	<b>2,282</b>	<b>162,733</b>	<b>24,409</b>	<b>187,142</b>	<b>18,717</b>	<b>205,859</b>									

表-15 小水力発電事業の事業費

Item	Site No. 1			Site No. 2			Combination		
	FC	IC	Total	FC	IC	Total	FC	IC	Total
	(Unit: 1,000 US\$)								
(1) Generating Equipment									
- Water turbine	496	-	496	646	-	646	1,142	-	1,142
- Generator	323	-	323	280	-	280	603	-	603
- Increaser	N/A	-	0	108	-	108	N/A	-	0
- Indoor switchgear	200	-	200	200	-	200	400	-	400
- DC supply	46	-	46	46	-	46	92	-	92
- Transformer	29	-	29	32	-	32	61	-	61
- Outdoor switchgear	67	-	67	67	-	67	133	-	133
(1) Sub-total:	1,161	-	1,161	1,378	-	1,378	2,539	-	2,539
(2) 13.8 kV Transmission Line & 69 kV Sub-station									
- Transformer	40	-	40	43	-	43	63	-	63
- 69 kV & 13.8 kV sub-station	251	-	251	251	-	251	251	-	251
- 13.8 kV T/L	11	14	25	70	89	160	81	103	185
(2) Sub-total:	302	14	316	365	89	454	396	103	499
(3) Penstock	-	60	60	-	63	63	-	123	123
(4) Intake Gate	-	26	26	-	26	26	-	51	51
(5) Civil Work	-	427	427	-	507	507	-	934	934
(6) Sub-total of (1) to (5)	1,463	526	1,989	1,743	685	2,429	2,935	1,212	4,147
(7) Engineering and Administration Cost	219	79	298	262	103	364	440	182	622
(8) Sub-total of (6) to (7)	1,682	605	2,288	2,005	788	2,793	3,376	1,393	4,769
(9) Contingency	168	61	229	200	79	279	338	139	477
(10) Project Cost (8) to (9)	1,850	666	2,516	2,205	867	3,072	3,713	1,533	5,246

Remarks: FC: Foreign currency, IC: Local currency

表-16 事業資金

(Unit: 1,000 Peso)

	1st. Year		2nd. Year		3rd. Year		Total				
	FC	LC	FC	LC	FC	LC	FC	LC			
I. Fund Requirement for 6 Pump Irrigation Systems											
(1) Direct tapping											
Bonga #1	1,453	949	19,917	2,178	22,095	2,054	3,887	5,941	23,424	7,014	30,438
Bonga #2	1,859	1,039	26,158	1,883	28,041	1,922	4,007	5,929	29,939	6,929	36,868
Bonga #3	865	220	11,852	1,086	12,938	1,245	1,947	3,192	13,962	3,253	17,215
Alcala-Amulung	1,110	1,957	3,067	11,078	19,759	5,909	9,550	15,459	18,097	20,188	38,285
Solana	4,115	2,057	6,172	53,847	64,411	8,477	14,303	22,780	66,439	26,924	93,363
Libmanan-Cabusao	3,061	2,144	5,205	36,150	48,354	10,413	14,764	25,177	49,624	29,112	78,736
Total	12,463	8,366	20,829	159,002	195,598	30,020	48,458	78,478	201,485	93,420	294,905
(2) Indirect tapping											
Bonga #1	1,078	899	1,977	14,460	16,611	1,846	3,050	4,896	17,384	6,100	23,484
Bonga #2	1,390	976	2,366	19,333	21,180	1,662	2,959	4,621	22,385	5,782	28,167
Bonga #3	773	208	981	10,488	11,567	1,192	1,736	2,928	12,453	3,023	15,476
Alcala-Amulung	1,110	1,957	3,067	11,078	19,759	5,909	9,550	15,459	18,097	20,188	38,285
Solana	3,575	2,018	5,593	46,023	56,566	8,180	13,675	21,855	57,778	26,236	84,014
Libmanan-Cabusao	2,216	2,095	4,311	23,866	36,043	9,946	13,947	23,893	36,028	28,219	64,247
Total	10,142	8,153	18,295	125,248	161,726	28,735	44,917	73,652	164,125	89,548	253,673
II. Fund Requirement for Mini-Hydropower Development											
(1) Site No.1	25,704	10,164	35,868	17,997	7,434	25,431	-	-	43,701	17,598	61,299
(2) Site No.2	30,639	13,230	43,869	21,441	9,681	31,122	-	-	52,080	22,911	74,991
(3) Combination	51,576	23,373	74,949	36,099	17,136	53,235	-	-	87,675	40,509	128,184

Remarks: F.C; Foreign currency  
LC; Local currency

表-17 灌溉事業の運営、維持管理費及び更新費

(Unit: 1,000 Pesos)

Year in Order	Bonga #1			Bonga #2			Irrigation			Acala-Abulung			Solana			Libmanan-Cabuso			Mini-hydro-power		
	Direct	Indirect	Replace	Direct	Indirect	Replace	Direct	Indirect	Replace	Direct	Indirect	Replace	Direct	Indirect	Replace	Direct	Indirect	Replace	Site No.	Compa- tion	
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	812	1,366	1,293	1,366	1,061	2,152	1,691	0	0	0	0	0	0	0	0	0	0	0	798	966	1,659
5	812	0	1,293	0	1,061	0	1,691	0	434	0	434	0	434	0	434	0	434	0	798	966	1,659
6	812	0	1,293	0	1,061	0	1,691	0	434	0	434	0	434	0	434	0	434	0	798	966	1,659
7	812	0	1,293	0	1,061	0	1,691	0	434	0	434	0	434	0	434	0	434	0	798	966	1,659
8	812	0	1,293	0	1,061	0	1,691	0	434	0	434	0	434	0	434	0	434	0	798	966	1,659
9	812	0	1,293	0	1,061	0	1,691	0	434	0	434	0	434	0	434	0	434	0	798	966	1,659
10	812	0	1,293	0	1,061	0	1,691	0	434	0	434	0	434	0	434	0	434	0	798	966	1,659
11	812	0	1,293	0	1,061	0	1,691	0	434	0	434	0	434	0	434	0	434	0	798	966	1,659
12	812	1,914	1,293	1,914	1,061	3,014	1,691	3,014	877	649	877	4,944	4,281	5,516	4,807	4,757	4,807	4,757	798	966	1,659
13	812	0	1,293	0	1,061	0	1,691	0	434	0	434	0	434	0	434	0	434	0	798	966	1,659
14	812	1,366	1,293	1,366	1,061	2,152	1,691	2,152	434	621	434	6,349	6,349	0	6,888	0	6,888	0	798	966	1,659
15	812	0	1,293	0	1,061	0	1,691	0	434	0	434	0	434	0	434	0	434	0	798	966	1,659
16	812	0	1,293	0	1,061	0	1,691	0	434	0	434	0	434	0	434	0	434	0	798	966	1,659
17	812	5,347	1,293	5,347	1,061	7,857	1,691	7,857	434	3,783	434	3,783	4,944	0	6,888	0	6,888	0	798	966	1,659
18	812	0	1,293	0	1,061	0	1,691	0	434	0	434	0	434	0	434	0	434	0	798	966	1,659
19	812	0	1,293	0	1,061	0	1,691	0	434	0	434	0	434	0	434	0	434	0	798	966	1,659
20	812	0	1,293	0	1,061	0	1,691	0	434	0	434	0	434	0	434	0	434	0	798	966	1,659
21	812	0	1,293	0	1,061	0	1,691	0	434	0	434	0	434	0	434	0	434	0	798	966	1,659
22	812	1,914	1,293	1,914	1,061	3,014	1,691	3,014	877	649	877	4,944	82,401	5,516	4,807	4,757	4,807	4,757	798	966	1,659
23	812	0	1,293	0	1,061	0	1,691	0	434	0	434	0	434	0	434	0	434	0	798	966	1,659
24	812	1,366	1,293	1,366	1,061	2,152	1,691	2,152	434	621	434	6,349	6,349	0	6,888	0	6,888	0	798	966	1,659
25	812	0	1,293	0	1,061	0	1,691	0	434	0	434	0	434	0	434	0	434	0	798	966	1,659
26	812	0	1,293	0	1,061	0	1,691	0	434	0	434	0	434	0	434	0	434	0	798	966	1,659
27	812	0	1,293	0	1,061	0	1,691	0	434	0	434	0	434	0	434	0	434	0	798	966	1,659
28	812	0	1,293	0	1,061	0	1,691	0	434	0	434	0	434	0	434	0	434	0	798	966	1,659
29	812	0	1,293	0	1,061	0	1,691	0	434	0	434	0	434	0	434	0	434	0	798	966	1,659
30	812	0	1,293	0	1,061	0	1,691	0	434	0	434	0	434	0	434	0	434	0	798	966	1,659
31	812	0	1,293	0	1,061	0	1,691	0	434	0	434	0	434	0	434	0	434	0	798	966	1,659
32	812	7,261	1,293	7,261	1,061	10,871	1,691	10,871	434	4,103	434	4,103	4,944	4,281	26,466	7,228	4,757	7,228	798	966	1,659
33	812	0	1,293	0	1,061	0	1,691	0	434	0	434	0	434	0	434	0	434	0	798	966	1,659
34	812	1,366	1,293	1,366	1,061	2,152	1,691	2,152	434	621	434	6,349	6,349	0	6,888	0	6,888	0	798	966	1,659
35	812	0	1,293	0	1,061	0	1,691	0	434	0	434	0	434	0	434	0	434	0	798	966	1,659
36	812	0	1,293	0	1,061	0	1,691	0	434	0	434	0	434	0	434	0	434	0	798	966	1,659
37	812	7,770	1,293	7,770	1,061	9,436	1,691	9,436	434	6,886	434	6,886	4,944	78,120	11,024	4,417	4,417	4,417	798	966	1,659
38	812	0	1,293	0	1,061	0	1,691	0	434	0	434	0	434	0	434	0	434	0	798	966	1,659
39	812	0	1,293	0	1,061	0	1,691	0	434	0	434	0	434	0	434	0	434	0	798	966	1,659
40	812	0	1,293	0	1,061	0	1,691	0	434	0	434	0	434	0	434	0	434	0	798	966	1,659
41	812	0	1,293	0	1,061	0	1,691	0	434	0	434	0	434	0	434	0	434	0	798	966	1,659
42	812	1,914	1,293	1,914	1,061	3,014	1,691	3,014	877	649	877	4,944	4,281	5,516	4,807	4,757	4,807	4,757	798	966	1,659
43	812	0	1,293	0	1,061	0	1,691	0	434	0	434	0	434	0	434	0	434	0	798	966	1,659
44	812	1,366	1,293	1,366	1,061	2,152	1,691	2,152	434	621	434	6,349	6,349	0	6,888	0	6,888	0	798	966	1,659
45	812	0	1,293	0	1,061	0	1,691	0	434	0	434	0	434	0	434	0	434	0	798	966	1,659
46	812	0	1,293	0	1,061	0	1,691	0	434	0	434	0	434	0	434	0	434	0	798	966	1,659
47	812	5,347	1,293	5,347	1,061	7,857	1,691	7,857	434	3,783	434	3,783	4,944	20,952	2,421	4,757	2,421	4,757	798	966	1,659
48	812	0	1,293	0	1,061	0	1,691	0	434	0	434	0	434	0	434	0	434	0	798	966	1,659
49	812	0	1,293	0	1,061	0	1,691	0	434	0	434	0	434	0	434	0	434	0	798	966	1,659
50	812	0	1,293	0	1,061	0	1,691	0	434	0	434	0	434	0	434	0	434	0	798	966	1,659

表-18 作物及び投入資材の経済価格

Description	Unit	Operation	Region		
			I	II	V
<b>A. Rice (Import Parity)</b>					
1) Projected 1995 International Market Price (FOB Bangkok, 5% broken rice)	US\$/ton		293	293	293
2) Adjust Quantity to 25-35% Broken	US\$/ton	x 0.86	252	252	252
3) Ocean Freight and Insurance	US\$/ton	+	30	30	30
4) CIF Manila	US\$/ton	=	282	282	282
5) Converted to Philippine Peso	Peso/ton	x 21.0	5,926	5,926	5,926
6) Cost for Port Charge, Handling and Warehousing	Peso/ton	+	360	360	360
7) NFA Administration Charge	Peso/ton	+	70	70	70
8) Wholesale Price of Rice in Manila	Peso/ton	=	6,356	6,356	6,356
9) Transportation Cost (Manila to Region Capital)	Peso/ton	-	326	231	308
10) Price of Rice at Ex-mill Gate	Peso/ton	=	6,030	6,125	6,048
11) Milling Cost	Peso/ton	-	147	148	178
12) Conversion to Price of Dried Paddy	Peso/ton	x 0.65	3,824	3,885	3,815
13) Cost for Transportation and Handling (Farm Gate to Mill)	Peso/ton	-	52	39	51
14) Farm Gate Price of Dried Paddy	Peso/ton (Peso/kg)	=	3,772 (3.77)	3,846 (3.85)	3,764 (3.76)
<b>B. Corn (Import Parity)</b>					
a) Projected 1995 International Market Price (FOB US Gulf, TSP, Bulk)	US\$/ton		-	130	-
b) Ocean Freight and Insurance	US\$/ton	+	-	39	-
c) CIF Price at Manila	US\$/ton	=	-	169	-
d) Converted to Philippine Peso	Peso/ton	x 21.0	-	3,559	-
e) Cost for Port Charge, Handling and Warehousing	Peso/ton	+	-	220	-
f) Ex-warehouse Price	Peso/ton	=	-	3,779	-
g) Cost for Transportation, Handling and Retail Margin	Peso/ton	+	-	300	-
h) Farm Gate Price	Peso/ton (Peso/kg)	=	-	4,079 (4.08)	-
<b>C. Fertilizers (Import Parity)</b>					
1) Nitrogen					
a) Projected 1995 International Market Price (FOB N.W. Europe, Urea, Bagged)	US\$/ton		229	229	229
b) Ocean Freight and Insurance	US\$/ton	+	33	33	33
c) CIF Price at Manila	US\$/ton	=	262	262	262
d) Converted to Philippine Peso	Peso/ton	x 21.0	5,495	5,495	5,495
e) Cost for Port Charge, Handling and Warehousing	Peso/ton	+	220	220	220
f) Ex-warehouse Price	Peso/ton	=	5,715	5,715	5,715
g) Cost for Transportation, Handling and Retail Margin	Peso/ton	+	375	300	360
h) Farm Gate Price	Peso/ton	=	6,090	6,015	6,075
i) Conversion to Price of Nitrogen (N)	Peso/ton (Peso/kg)	x 2.22	13,521 (13.52)	13,354 (13.35)	13,488 (13.49)
2) Phosphorus					
a) Projected 1995 International Market Price (FOB US Gulf, TSP, Bulk)	US\$/ton		199	199	199
b) Ocean Freight and Insurance	US\$/ton	+	39	39	39
c) CIF Price at Manila	US\$/ton	=	238	238	238
d) Converted to Philippine Peso	Peso/ton	x 21.0	5,003	5,003	5,003
e) Cost for Port Charge, Handling and Warehousing	Peso/ton	+	220	220	220
f) Ex-warehouse Price	Peso/ton	=	5,223	5,223	5,223
g) Cost for Transportation, Handling and Retail Margin	Peso/ton	+	375	300	360
h) Farm Gate Price	Peso/ton	=	5,598	5,523	5,583
i) Conversion to Price of Phosphorus (P)	Peso/ton (Peso/kg)	x 4.55	25,470 (25.47)	25,128 (25.13)	25,401 (25.40)
3) Potassium					
a) Projected 1995 International Market Price (FOB Vancouver, Muriate of Potash, Bulk)	US\$/ton		114	114	114
b) Ocean Freight and Insurance	US\$/ton	+	33	33	33
c) CIF Price at Manila	US\$/ton	=	147	147	147
d) Converted to Philippine Peso	Peso/ton	x 21.0	3,080	3,080	3,080
e) Cost for Port Charge, Handling and Warehousing	Peso/ton	+	220	220	220
f) Ex-warehouse Price	Peso/ton	=	3,300	3,300	3,300
g) Cost for Transportation, Handling and Retail Margin	Peso/ton	+	375	300	360
h) Farm Gate Price	Peso/ton	=	3,675	3,600	3,660
i) Conversion to Price of Potassium (K)	Peso/ton (Peso/kg)	x 1.92	7,055 (7.06)	6,911 (6.91)	7,026 (7.03)

Remarks : Region I ; Bonga Pump #1, #2 and #3  
 Region II ; Alcala-Amulung, Solana  
 Region V ; Libmanan-Cabusao

Source : Half-Yearly Revision of Commodity Price Forecasts, IBRD, February 1, 1988  
 Data were obtained from following Authorities ;  
 National Food Authority (NFA),  
 National Economic and Development Authority (NEDA),  
 Philippine National Lines, and  
 Fertilizer and Pesticide Authority.



図-1 国营ポンプ灌漑システム改善計画の基本構想

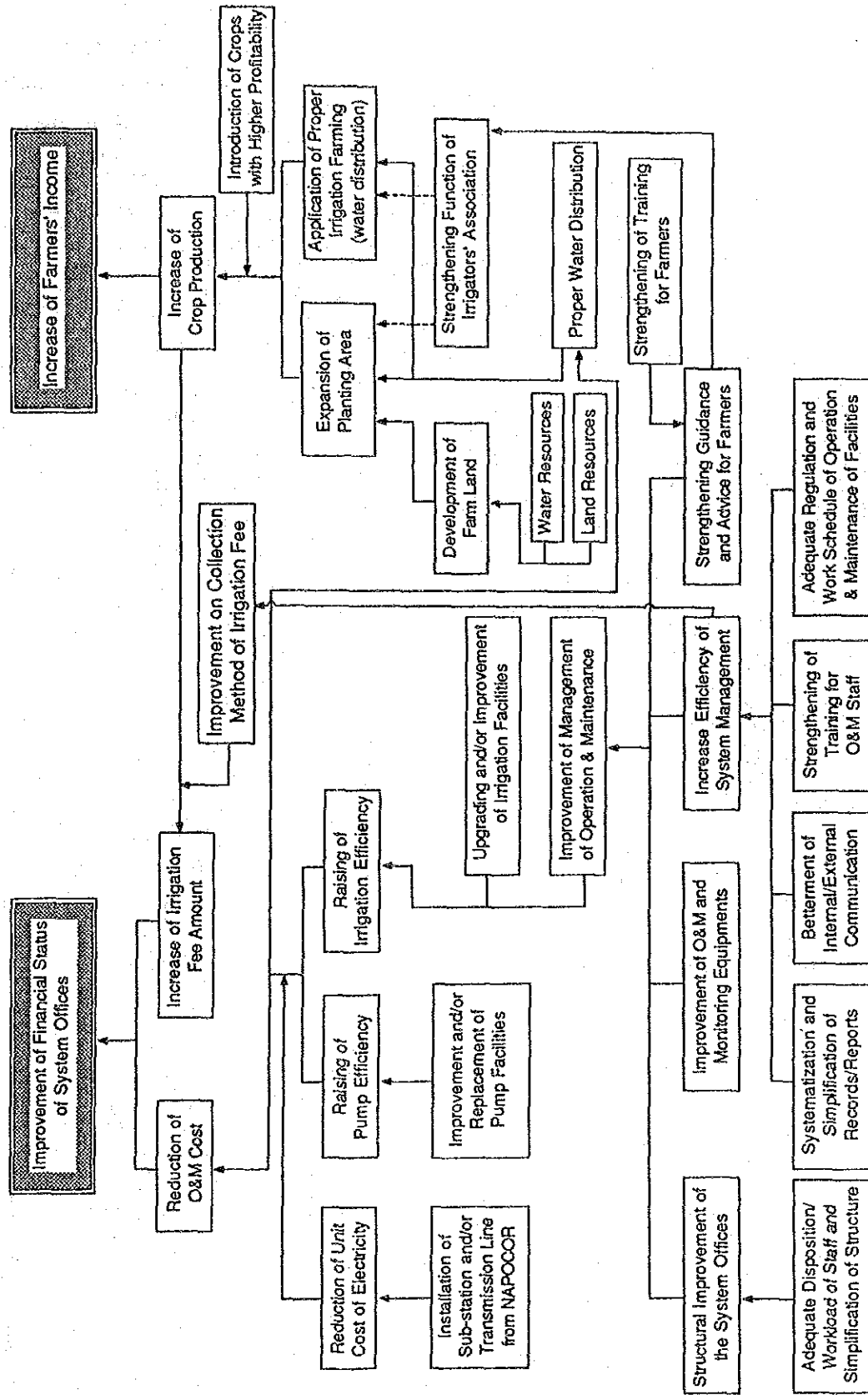
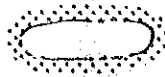
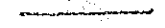
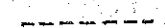

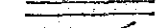
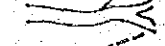
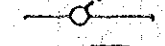



図-2 ボンガポンプ#1灌漑システム概要図

LEGEND :

-  Irrigation Area
-  Main Canal
-  Lateral / Sublateral Canal
-  Pump Station
-  Road
-  River / Creek
-  Headgate
-  Residential / Hilly Area

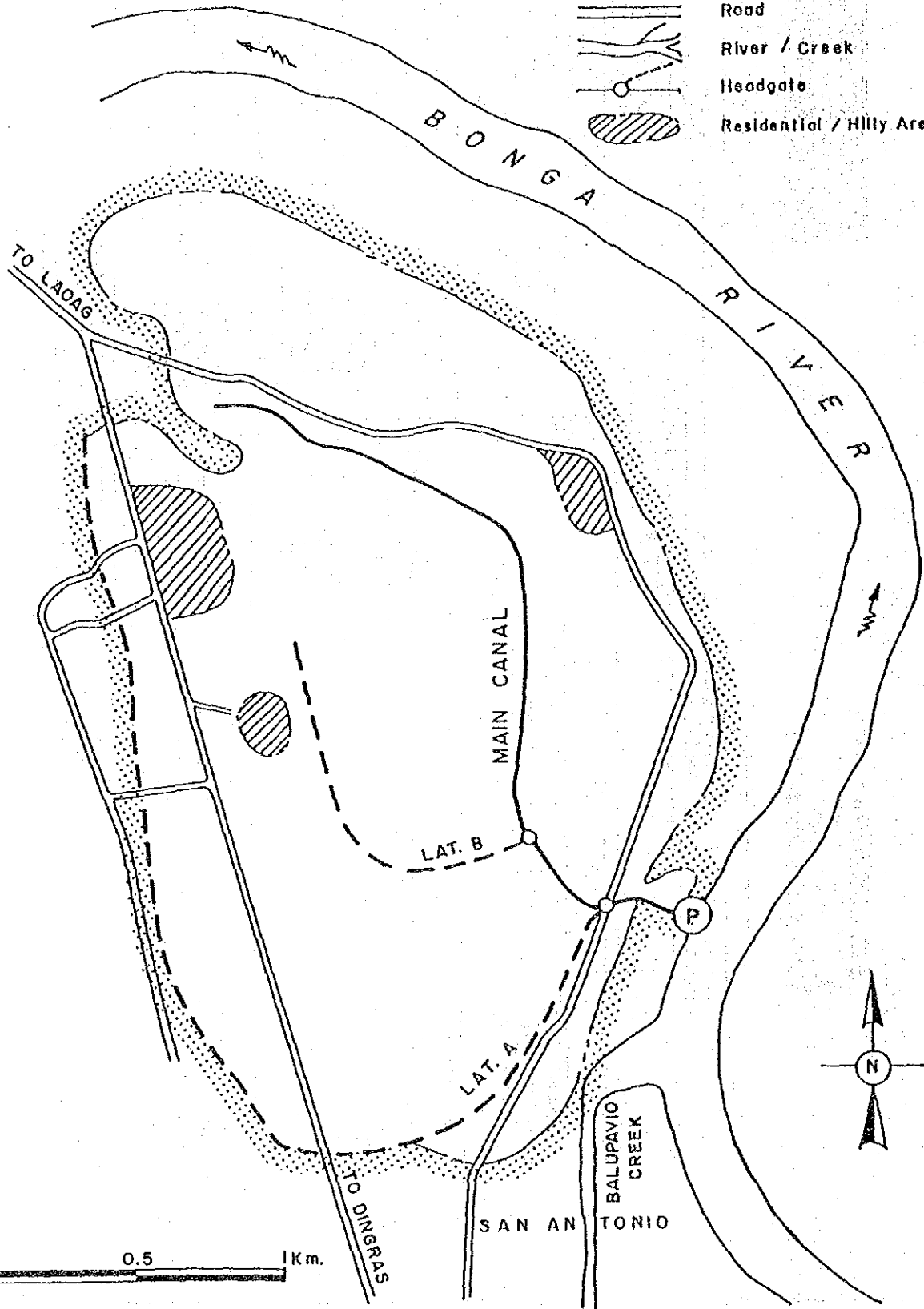


図-3 ボンガポンプ#2灌漑システム概要図

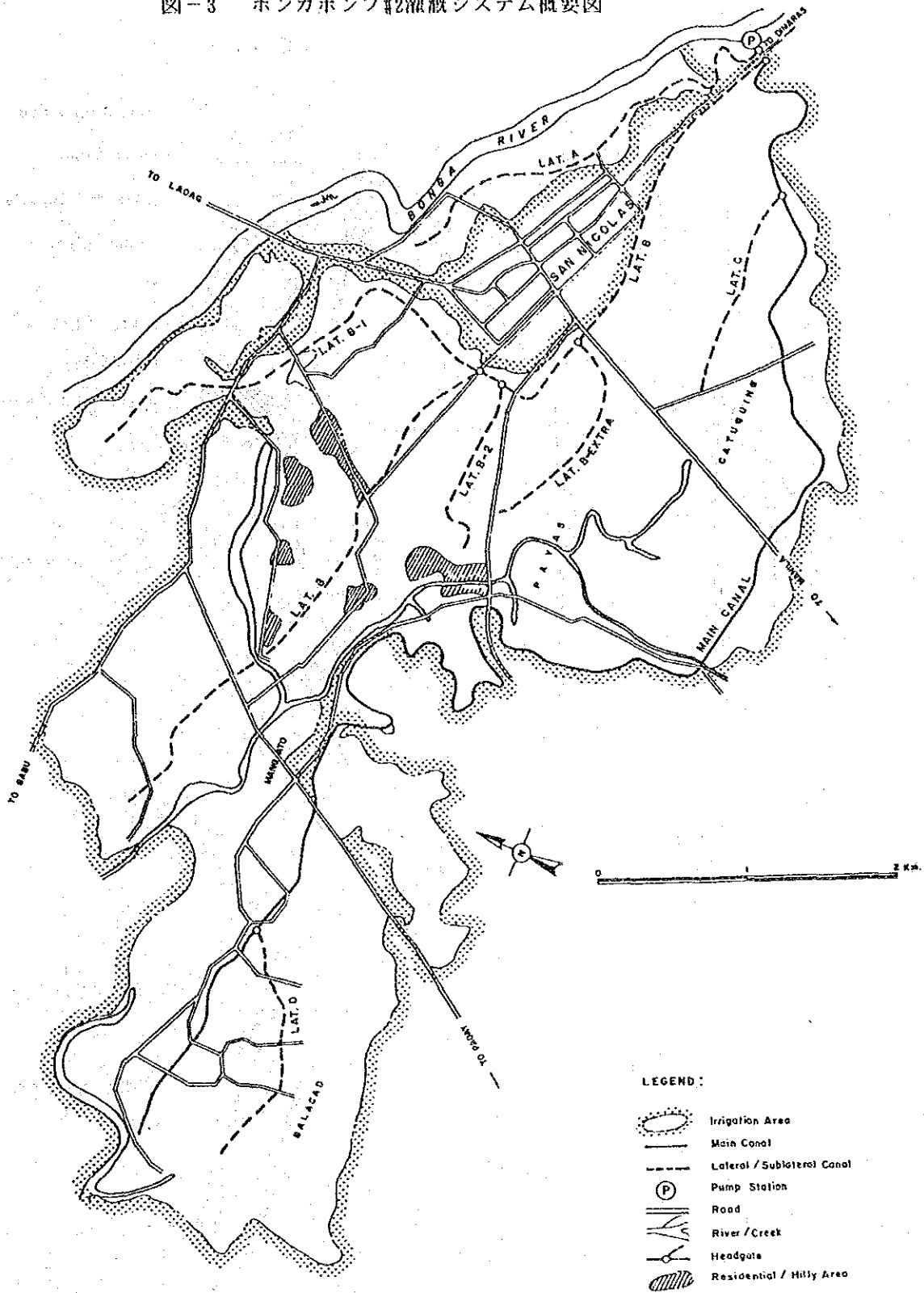


図-4 ボンガポンプ#3灌漑システム概要図

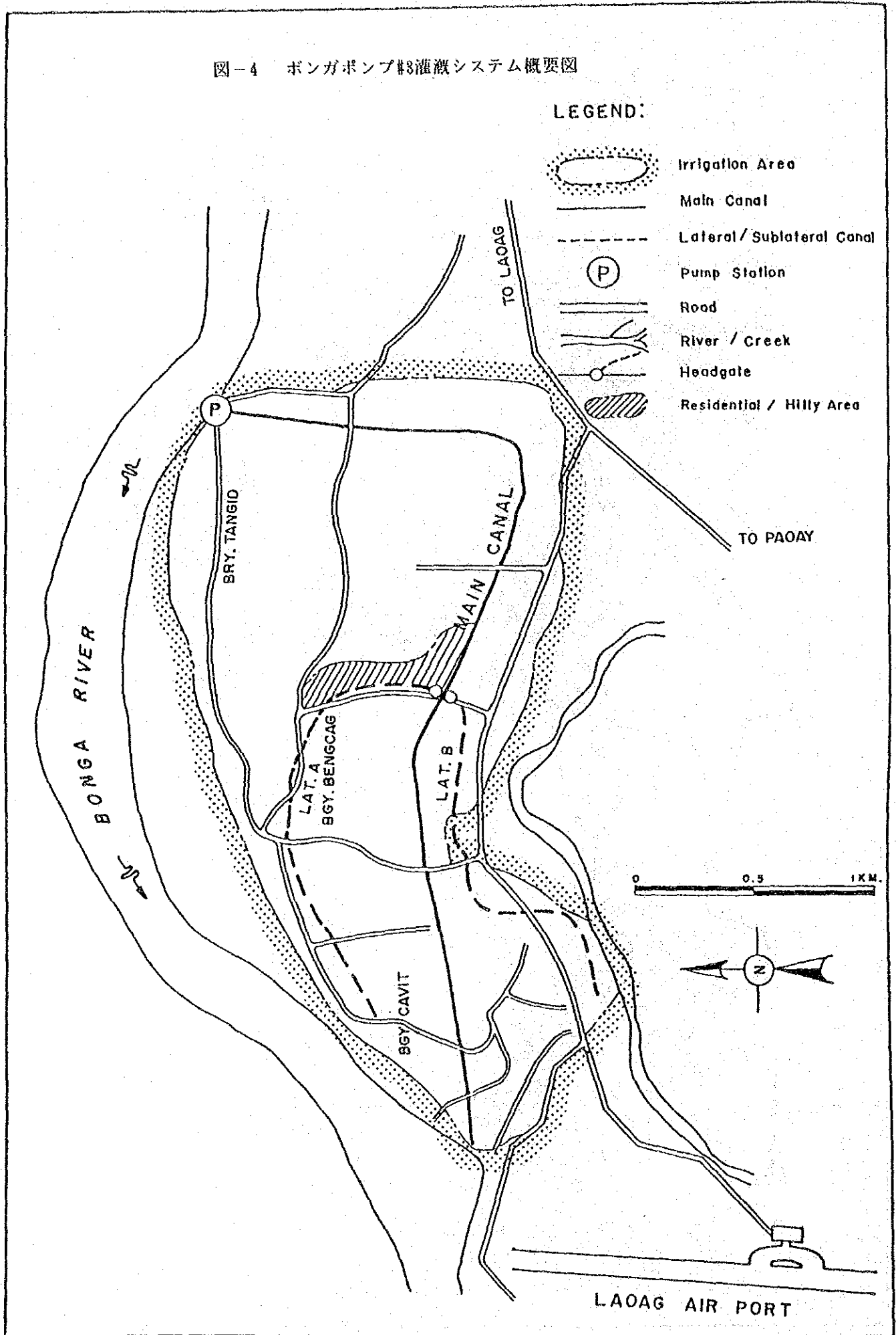


図-5 アルカラ-アムルンポンプ灌漑システム概要図

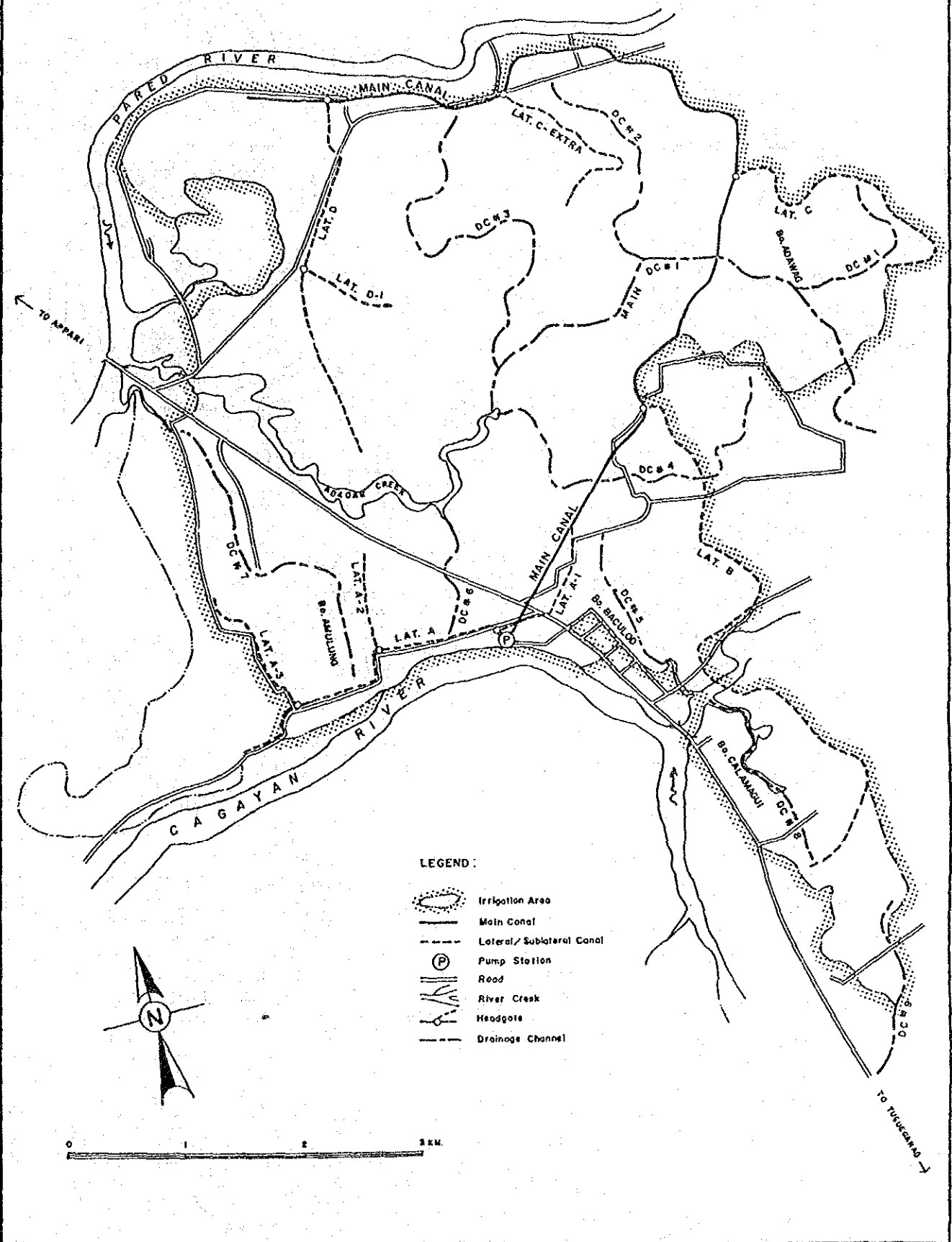


図-6 ソラナポンプ灌漑システム概要図

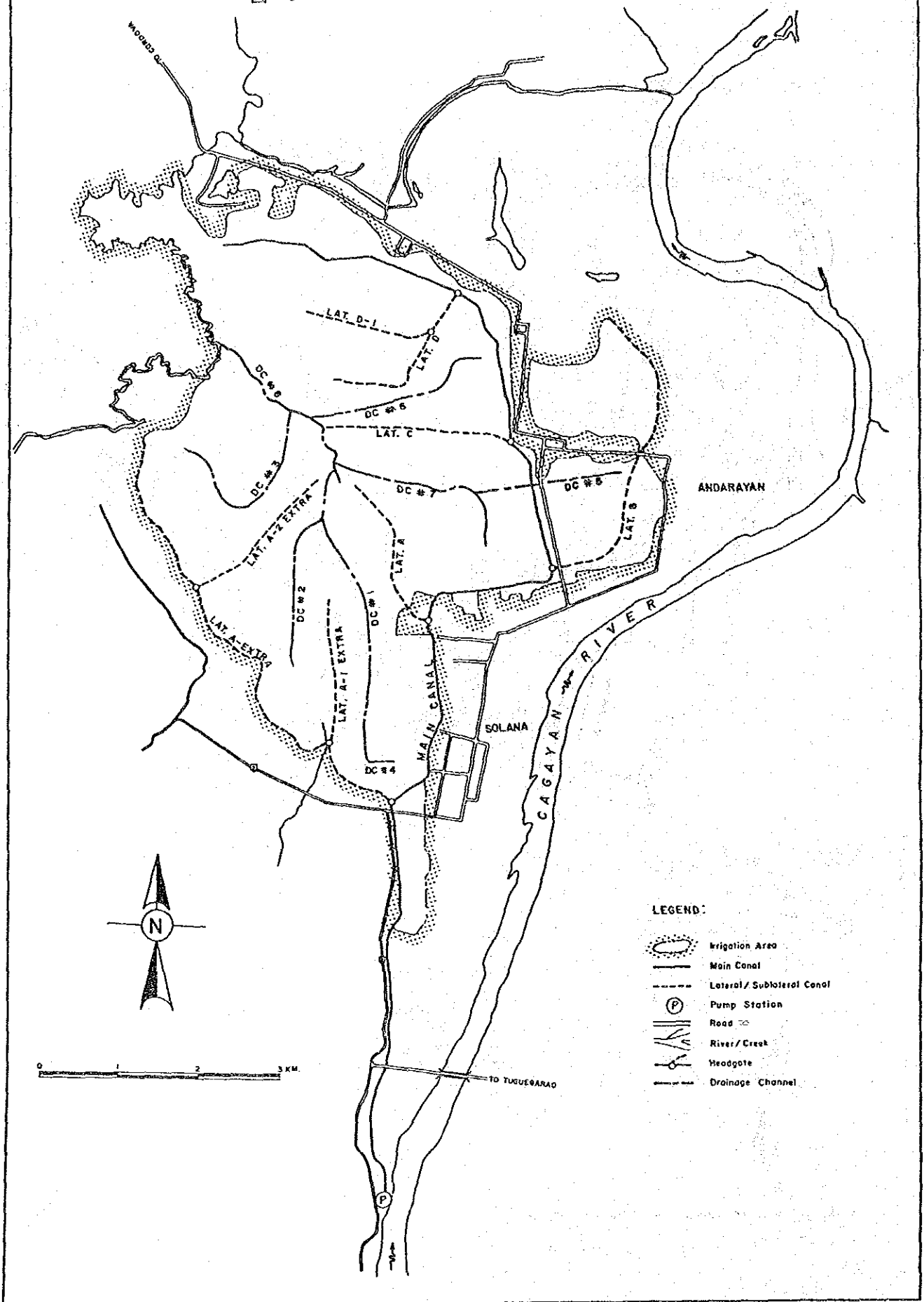


図-7 リブマナン-カブサオポンプ灌漑システム概要図

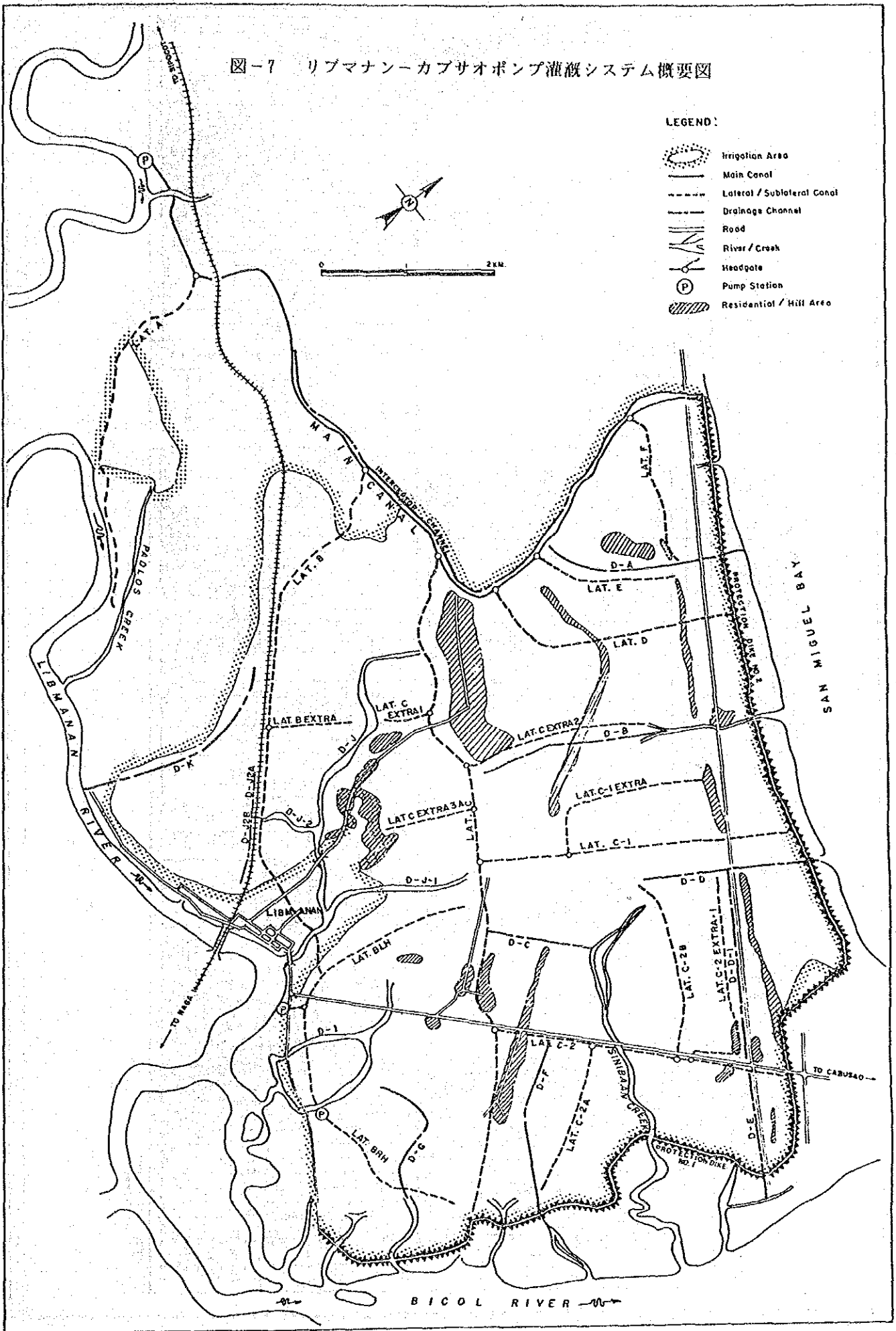
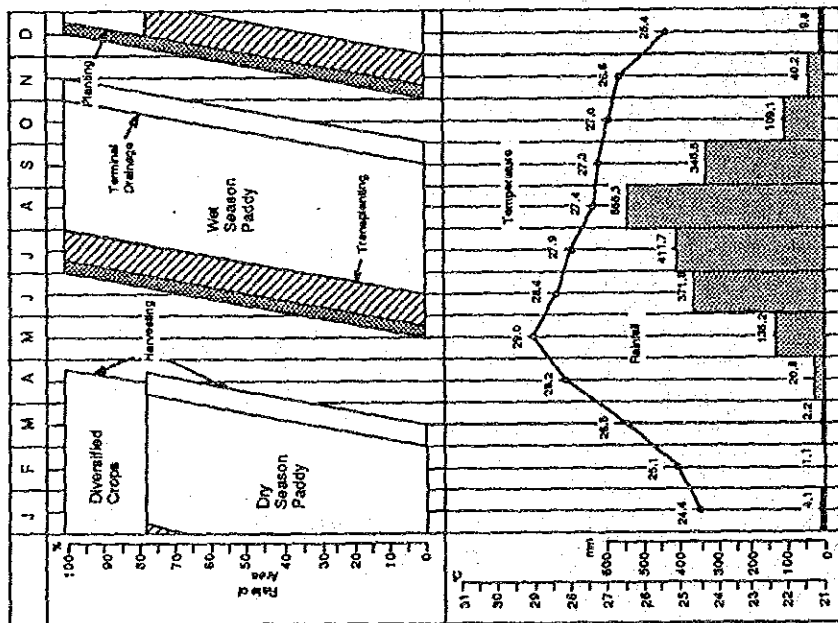
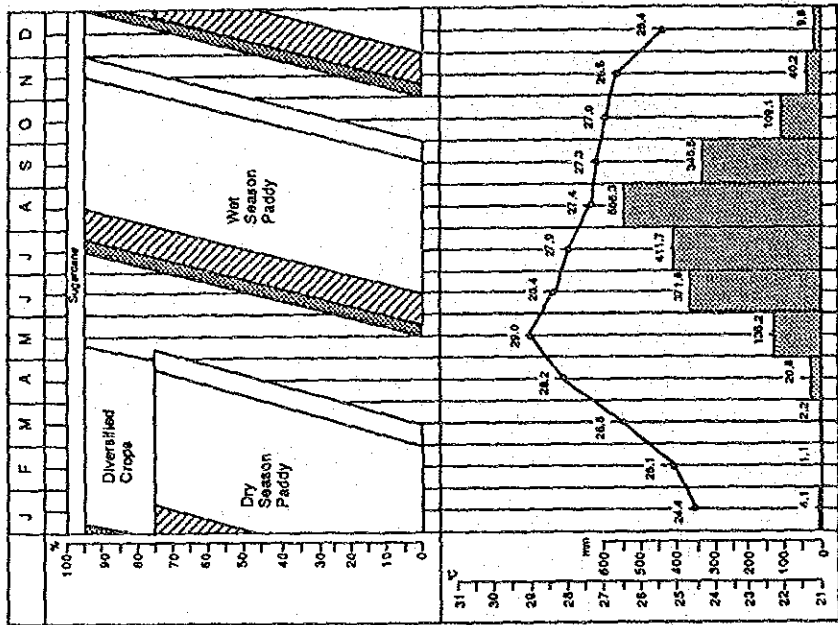


図-8 (1/2) 計画作付体系

BONGA #1



BONGA #2



BONGA #3

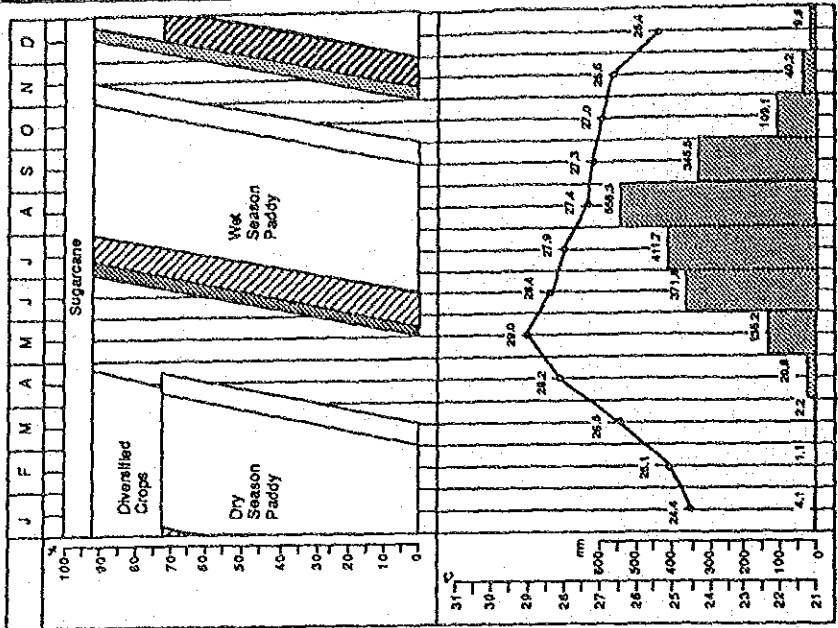
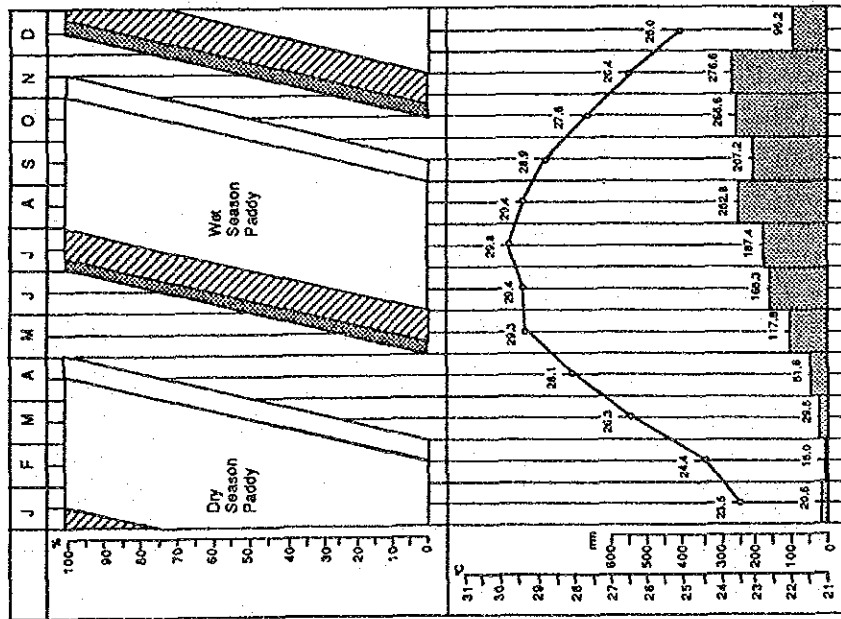


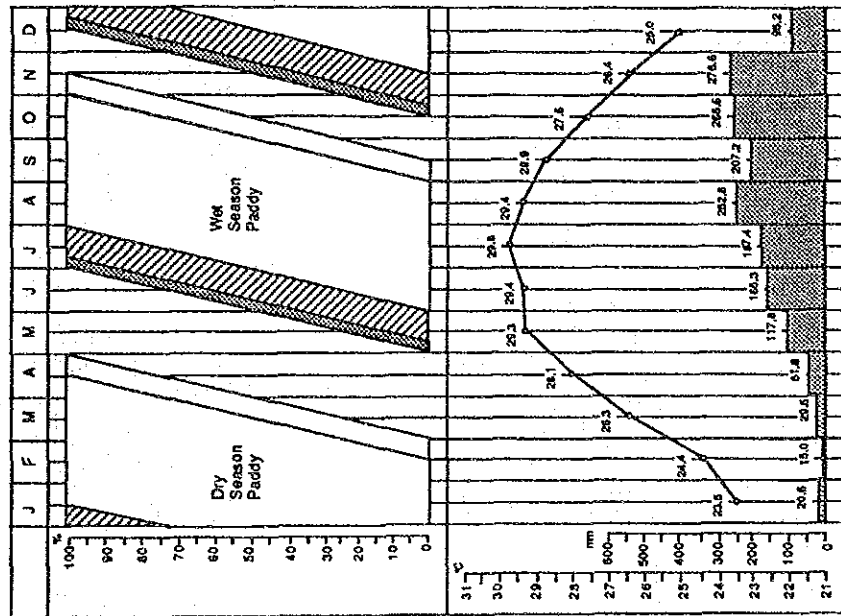


图-8 (2/2) 計畫作付体系

ALCALA-AMULUNG



SOLANA



LIBMANAN-CABUSAO

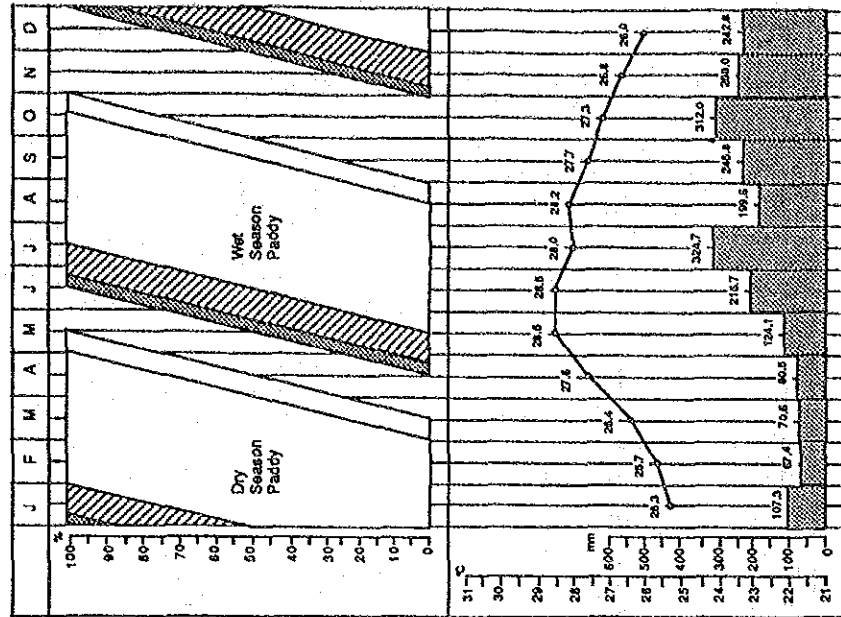


図-9 小水力発電所 No.1 地点の概要

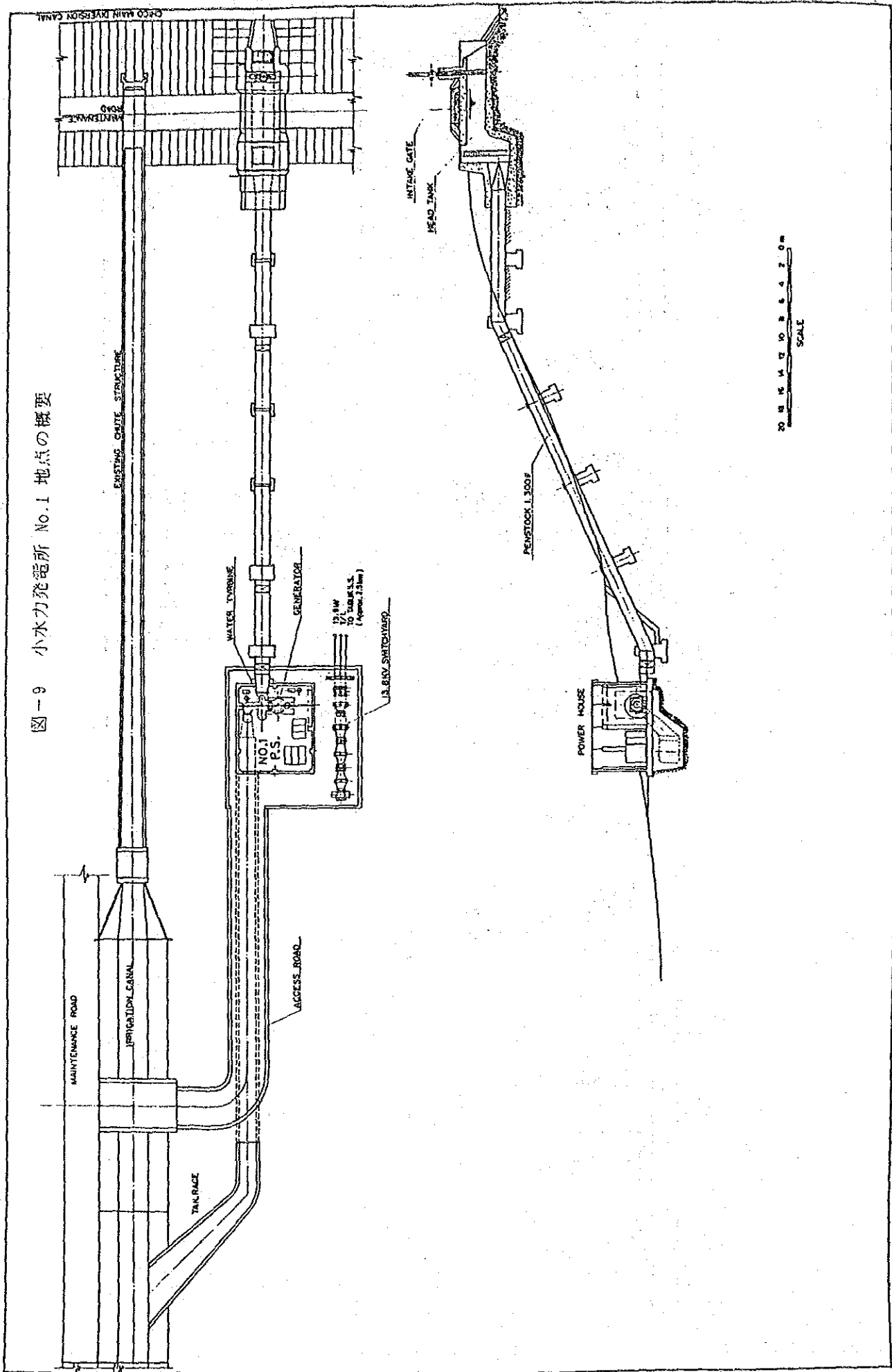
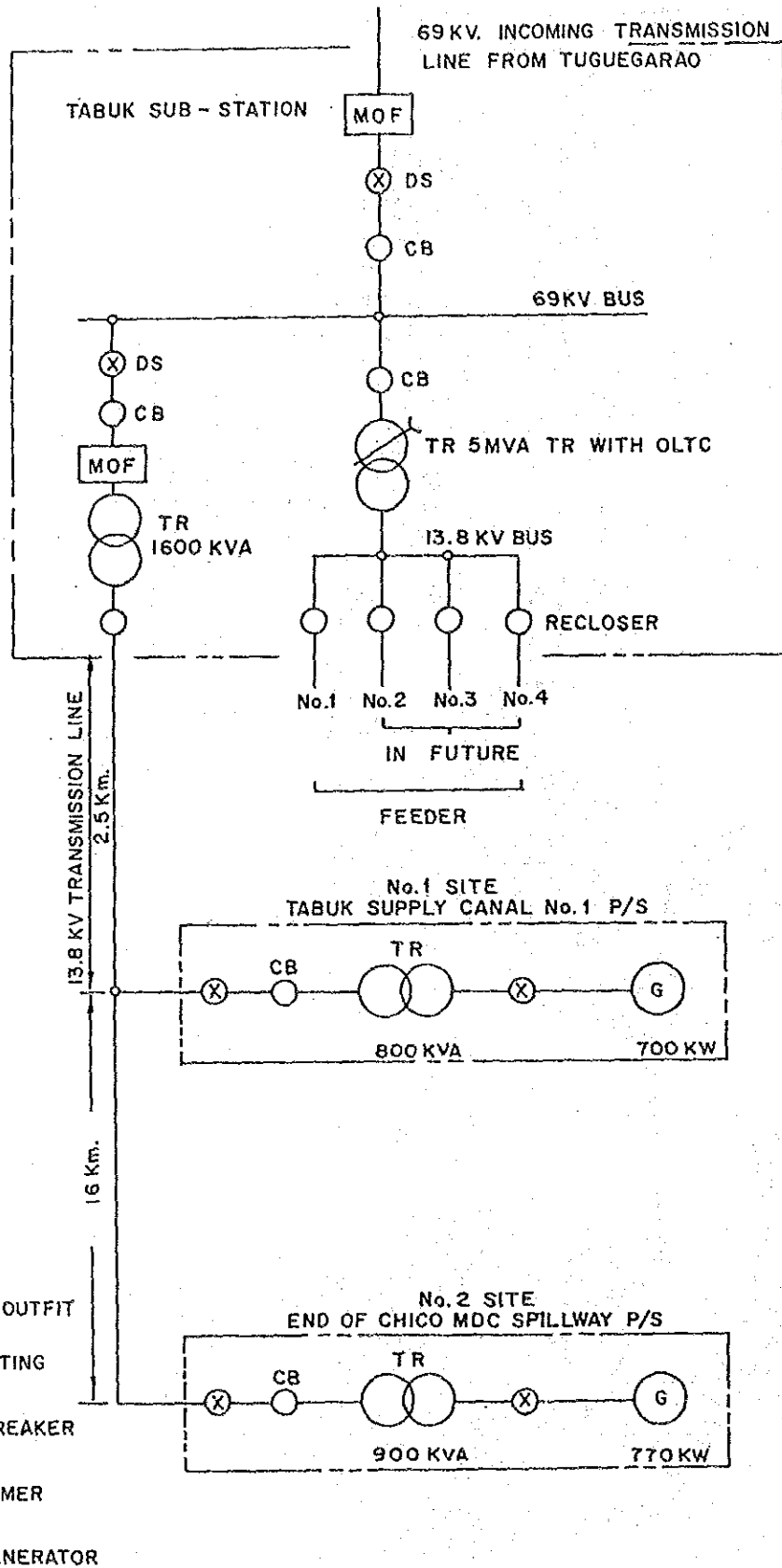




図-11 チコ川灌漑システムにおける小水力発電システム単線結線図





JICA