REPUBLIC OF INDONESIA
MINISTRY OF AGRICULTURE
DIRECTORATE GENERAL OF FOOD CROPS AGRICULTURE

FEASIBILITY STUDY FOR LAND DEVELOPMENT PROJECT IMPROVEMENT OF LAND AND IRRIGATION SYSTEMS AT FARM LEVEL

SUMMARY

OCTOBER, 1992

JAPAN INTERNATIONAL COOPERATION AGENCY
TOKYO, JAPAN

LOCATION
OF
THE FEASIBILITY STUDY ON THE LAND DEVELOPMENT
-IMPROVEMENT OF LAND AND IRRIGATION SYSTEM AT FARM LEVEL-

PROVINCE OF INVENTORY SURVEY

JICA :

DGFCA :

ACHE

NORTH SUMATRA

CENTRAL SULAWESI

SOUTH SULAWESI

SOUTHEAST SULAWESI

LAMPUNG

WEST NUSA TENGGARA

EAST NUSA TENGGARA

PROPINSI RIAU

PROPINSI KALIMANTAN TIMUR

PROPINSI SULAWESI UTARA

PROPINSI KALIMANTAN BARAT

PROPINSI SUMATERA BARAT

PROPINSI JAMBI

PROPINSI KALIMANTAN TENGAH

PROPINSI SUMATERA SELATAN

PROPINSI KALIMANTAN SELATAN

PROPINSI BENGKULU

PROPINSI MALUKU

PROPINSI IRIAN JAYA

DAERAH KHUSUS IBUKOTA JAKARTA

PROPINSI JAWA BARAT

PROPINSI JAWA TENGAH

PROPINSI JAWA TIMUR

DAERAH ISTIMEWA YOGYAKARTA

PROPINSI BALI

PROPINSI NUSA TENGGARA BARAT

PROPINSI NUSA TENGGARA TIMUR

REPUBLIC OF INDONESIA MINISTRY OF AGRICULTURE
DIRECTORATE GENERAL OF FOOD CROPS AGRICULTURE
FEASIBILITY STUDY OF LAND DEVELOPMENT PROJEC
IMPROVEMENT OF LAND AND IRRIGATION SYSTEMS
AT FARM LEVEL

LOCATION MAP

JAPAN INTERNATIONAL COOPERATION AGENCY
TOKYO (JICA)

DWG NO 1

FEASIBILITY STUDY
FOR
LAND DEVELOPMENT PROJECT
IMPROVEMENT OF LAND & IRRIGATION SYSTEM AT FARM LEVEL

SUMMARY REPORT

CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

1. The feasibility study for the Land Development Project-Improvement of Land and Irrigation System at Farm Level has been carried out since march 1991 in accordance with the Scope of Work and the Minutes of Understandings agreed upon in November 1990 between the Government of Indonesia and the Government of Japan. This report presents the development plan formulated on the basis of the field survey and the analysis in Japan for the feasibility study for the Project.

2. The Republic of Indonesia has peculiar circumstances such as centralization of population on Java Island and high population growth ratio reached to about 2.2% as of 1990. To overwhelm these matters,the Government of Indonesia strongly implemented the transmigration projects to the outer islands, and the irrigation and agricultural development projects for large rural population who were mostly engaged and kept their livelihood in agriculture during Repelita I to IV since 1969.

3. Actually, however, the investment for the operation and maintenance of the irrigation systems was comparatively small during the above period. Consequently, many systems are in poor physical conditions. For this, the Government of Indonesia recognizes the importance of O&M to maintain the self-sufficiency of rice and gives priority to the upgrading and rehabilitation, and O&M of existing small and medium-scale irrigation schemes, and further carries on the introduction of irrigation service fee for the cost recovery of O&M costs and the handling-over of the small scale schemes of which each area is less than 150 ha to the farmers' organization after improving the technical level of the scheme by the projects for upgrading and rehabilitation, efficient O&M, special maintenance,etc.

4. About 860,000 ha in the existing irrigation schemes mainly handled by the Directorates except the Directorate of Swamp of DGWRD are estimated as potential areas to be still developed. Out of 860,000, it is said that the farm land of about 300,000 ha remains undeveloped notwithstanding that the main systems for irrigation have been completed. For this, the Directorate of Land Rehabilitation and Development (DLRD), DGFCA has implemented the land development of 375,000 ha, a target for Repelita V including the development in swamps and village irrigation schemes. However, the above 300,000 ha includes the schemes which require the construction and/ or rehabilitation of tertiary canal,or the schemes for which the land development is difficult

because of the shortage of water ,or other various reasons. accordingly, it is necessary to do the detailed field survey on the schemes to check the actual conditions.

5. On the other hand, there are about one million ha of irrigation systems at farmers' level in the country which were constructed and have been maintained by farmers themselves to irrigate their lands. It is also recognized that these village irrigation systems play a significant role in meeting country's food requirements and in supporting lives of the rural population. However, many of such farmers' irrigation systems at farm level are damaged and not functioning well nor maintained well,and need frequent rehabilitation. There are the schemes that the following effects are expected by rehabilitation in such village irrigation schemes.

1) Stable paddy cultivation and decrease of damages
2) Increase of irrigated area in a scheme
3) Increase of irrigated area in dry season
4) Early occurrence of benefit
5) Cheeper construction cost due to the participation of farmers

Simple irrigation schemes are inferred to have larger effects than technical irrigation schemes due to 1),2) and 3) in the above.

6. To improve the small scale existing irrigation systems consisting of the schemes with necessity of land development and village irrigation schemes at farm level for which the investment have been smaller up to present are considered to contribute not only to the self-sufficiency of rice,but also to the raise of income and stable livelihood of the farmers and the alleviation of poverty.

CONTENTS AND RESULTS OF THE STUDY

7. The objective of the Study is to formulate the land development project -improvement of land and irrigation systems at farm level- for existing on-farm irrigation areas in three (3) provinces (North Sumatra, South Sulawesi and West Tenggara). In addition, the technical cooperation about the methodology and the sample check is to be provided on the inventory survey conducted by the Government of Indonesia in five (5) provinces (Ache, Lampung, Central Sulawesi, South East Sulawesi, and East Nusa Tenggara).

8. The Study is largely divided into the Phase I Study during the period from March to December 1991 and the Phase II Study from January to August 1992. The collection of information, inventory survey, selection of representative schemes for the feasibility study, decision on the development basic concepts for the Project,etc. were carried out in the Phase I Study. In the Phase II Study, the feasibility study on the representative schemes, selection of the schemes for the Project, the study on the draft implementation program of the Project and other works were rendered.

9. The Study area consists of the schemes with necessity of land development (LD schemes) in the existing irrigation schemes and the village irrigation schemes (VI schemes) as described in the above. The following tables show the numbers and acreage of the schemes selected in each step for the Study dividing into the initial data collection, inventory survey, feasibility study and selection of the Project schemes.

NUMBERS OF OBJECTIVE SCHEMES

Unit : Number of Scheme

Division	North Sumatra		South Sulawesi		West Nusa Tenggara		Total		
	LD	VI	LD	VI	LD	VI	LD	VI	Total
Initial List	208	845	40	962	88	328	336	1,835	2,271
Inventory Survey	50	308	19	374	45	189	114	871	985
Feasibility Study	32	247	10	349	20	137	62	733	795
Formulation for Project	23	90	5	160	2	60	30	310	340

ACREAGE OF OBJECTIVE SCHEMES

Unit : ha

Division	North Sumatra		South Sulawesi		West Nusa Tenggara		Total		
	LD	VI	LD	VI	LD	VI	LD	VI	Total
Initial List Inventory Survey	17,535	121,775	6,484	149,260	16,930	35,499	40,948	306,534	347,482
Feasibility Study	11,438	46,157	4,886	44,079	25,073	19,984	41,397	110,220	151,617
Formulation for Project	6,916	30,500	3,046	41,479	10,568	15,750	20,530	87,729	108,259
	1,928	7,785	261	14,263	145	6,011	2,334	28,059	30,393

The guidelines for screening and selection of the schemes and the criteria for ranking to decide the priority schemes are studied and applied at each step of the Study. Especially, the detailed study on the representative schemes of 30 places in total, 10 places in average for three provinces was carried out in order to increase the accuracies for the estimation of construction cost and benefits.

As a result of the feasibility study on the objective schemes, the point of each scheme is estimated as follows ;

DISTRIBUTION OF EVALUATION RESULT OF FEASIBILITY STUDY

Unit : Number of Scheme

Division (Point)	North Sumatra		South Sulawesi		West Nusa Tenggara		Total		
	LD	VI	LD	VI	LD	VI	LD	VI	Total
0-30	9	0	5	0	18	0	32	0	32
31-40	0	1	0	4	0	0	0	5	5
41-50	0	3	0	52	0	3	0	58	58
51-60	0	21	1	91	0	29	1	141	142
61-70	1	58	0	69	1	25	2	152	154
71-80	4	93	2	88	0	66	6	247	253
81-90	16	68	2	41	1	14	19	123	142
91-100	2	3	0	4	0	0	2	7	9
Total	32	247	10	349	20	137	62	733	795

The ranking of the schemes of the feasibility study by province is decided as follows and the schemes classified as rank A are proposed for the Project.

RESULT OF RANKING

Unit : Number of Scheme

Division (Point)	North Sumatra		South Sulawesi		West Nusa Tenggara		Total		
	LD	VI	LD	VI	LD	VI	LD	VI	Total
A	23	90	5	160	2	60	30	310	340
B	0	118	0	151	0	44	0	313	313
C	9	39	5	38	18	33	32	110	142
Total	32	247	10	349	20	137	62	733	795

THE PROJECT

10. The objective schemes, 340 schemes of 30,400 ha in total for the Project consists of 30 schemes of 2,300 ha from the schemes with necessity of land development (LD schemes) in the existing irrigation schemes and 310 schemes of 28,100 ha from the village irrigation schemes (VI schemes).

11. It is recommendable to formulate the Project as a integrated land development project including land development schemes and village irrigation schemes. The project aims at accelerating land development at farm level in Indonesia. The project will precursorily cover eight provinces grouped into two, namely, North Sumatra(Sumut), South Sulawesi(Sulsel) and West Nusa Tenggara(NTB) in the first and Ache, Lampung, Central Sulawesi, South East Sulawesi and East Nusa Tenggara in the second.

12. Main objectives of the Project are as follows ;

1) To fully develop and rehabilitate on-farm facilities which are left behind in the existing irrigation schemes and village irrigation areas;
2) To achieve potential benefits of agriculture by irrigation development and thereby contribute to sustainable self-sufficiency of food crops;
3) To create new employment opportunities; and
4) To contribute to the alleviation of poverty in rural population of the project area.

The Project attempts to support the Government's current development strategy in the agriculture sector that focuses on stabilizing self sufficiency in food crops, creating rural employment opportunities and promoting balanced regional development.

13. The scope of the Project will consist of the following items.

1) To fully develop the existing irrigation, drainage and other infrastructure facilities at farm level to complete the land development work in existing irrigation schemes.
2) To thoroughly develop potential irrigation areas by upgrading and expanding existing irrigation, drainage and other infrastructure facilities in village irrigation areas

3) To strengthen the institutional capabilities of relevant agencies for management and coordination of the development. The agencies include those at provincial, district and sub-district levels, Water Users' Associations(P3A) and Rural Extension Centers(BPP).

14. The Project consists of four major components, i.e., land development, village irrigation development, institutional strengthening and strengthening of coordination and monitoring. These components are explained in detail as follows. The former two are concerned with development of physical infrastructures while the latter two focus on the managerial aspect of the Project.

(1) Land Development

This component of the Project intends to expand farm land by completing the land development works, including replotting and farm road to support intensification program, left undone in existing irrigation schemes managed by DGWRD. Rehabilitation and improvement of existing facilities in tertiary systems related to these land development works are also included. Prior to the commencement of the Project works, surveys, mapping, planning and detailed designs should be carried out for a smooth implementation of land development and tertiary development works.

(2) Village Irrigation Development

This component intends to increase crop intensity with possible expansion of irrigated agricultural land. Existing facilities in the village irrigation schemes are to be rehabilitated and/or upgraded. The scope will include surveys, mapping, planning and detailed designs, if necessary, followed by implementation of civil works for land development and facility rehabilitation/upgrading.

(3) Institutional Strengthening

The component for institutional strengthening will include:

1) To provide additional staff(s), when required, to BPP or other offices in the project schemes;
2) To train staffs of agricultural services at provincial, district and sub-district levels for the purpose of effective management of the Project;

3) To train provincial, district and rural extension staffs, as well as key farmers in the project schemes in water management and farm technologies for improved rice, secondary crops and/or tree crops.
4) To provide facilities and equipment for training, upon necessity.
5) To support establishment and/or strengthening of P3As and other farmer's groups for production in organizing arrangement and leveling up agricultural technique.
6) To train irrigators in the groups in O&M of tertiary and on-farm irrigation and drainage systems.

(4) Strengthening of Coordination and Monitoring

Coordination and monitoring of project implementation at the provincial and district levels, and at the Government and farm levels are planned to be made by BAPPEDA I(province) and BAPPEDA II(district). The Project will support these activities through arranging/offering office space, equipment and transportation facilities.

15. As a rule, the Ministry of Public Works (DPU) is responsible for the implementation of irrigation projects. However, the responsibility of DPU is generally limited up to the tertiary box equipped usually at the end of secondary canal. On-farm development within tertiary irrigation block such as construction of tertiary canal and its downstream canals, land clearing and leveling, construction of on-farm facilities, etc. are left to the farmers' hands. The rehabilitation of a small number of village irrigation schemes has been implemented by the Ministry of Agriculture, or the provincial Governments with the condition of the participation of farmers, but the implementation of the rehabilitation is apt to be delayed in its commencements because of the lack of fund and insufficient technique.

Consequently, it is desirable that the rehabilitation of canal systems at tertiary level in the land development schemes could be supported by DPU. On the other hand, the land clearing and leveling has been done by the budget of the Ministry of Agriculture.

As for the rehabilitation of village irrigation schemes, it is also recommendable that the works for the water source facilities and related structures are left to DPU and Provincial Irrigation Services (PRISs) and the works such as land clearing and leveling, and upgrading of on-farm facilities to the Ministry of Agriculture and Provincial Agricultural Services (PRASs),

while the paddy field formation is to be done by farmers themselves.

16. The principal executing agency responsible for the Project implementation is the Directorate General of Food Crops Agriculture (DGFCA) under the Ministry of Agriculture. Other executing agency is the Directorate General of Water Resources Development (DGWRD) under DPU, and it is recommendable that the coordination agency is BAPPENAS at national level. At provincial level, the executing agency consists of PRAS and PRIS and it is natural that the coordination agency is BAPPEDA.

17. The role of the central-level Government agencies will be mainly limited to planning, coordination and supervision of their respective components, technical guidance, selection and engagement of the consulting services in case with foreign consultants, and monitoring of loan disbursement, and liaison with a loan agency and other Government agencies at the national level.

Each project management unit at provincial level will serve as an operational unit for selection of subprojects, procurement of equipment and materials, loan disbursement, programming, managing, monitoring and coordinating of the various activities and for supervising the activities of the consultants.

It is necessary to coordinate the bidding works between the project management units in PRAS and PRIS because the survey and investigation, planning and design, and construction are desirable to be carried out by the same consultant or contractor for the same scheme.

18. The disbursement period of the loan for the Project is taken as seven (7) years after the end of 1994 taking into considerations the periods for selection of consultants and preparation, the periods of about four(4) and half years for design and construction, and the periods for post evaluation and other works.

19. The Project cost for the first three provinces is estimated as follows ;

ESTIMATED PROJECT COST

Unit : Million Rp.

Division	F/C	Total L/C	Total
1. Preparatory Works	1,550	1,033	2,583
2. Civil Works	19,659	19,659	39,318
3. Training & Demonstration	145	827	972
4. Institutional Strengthening	298	128	426
5. O & M Equipment	1,833	203	2,036
6. Land Acquisition	0	426	426
7. Administration	0	1,966	1,966
8. Consulting Services	7,819	1,956	9,775
Sub Total (1-8)	31,304	26,198	57,502
9. Physical Contingency	1,565	1,310	2,875
Total	32,869	27,508	60,377
10. Value Added Tax	-	5,799	5,799
11. Price Escalation	-	13,472	13,472
Grand Total	32,869	46,779	79,648
(Thousand US$)	16,435	23,389	39,824

Remarks ; 1 US$ = Rp. 2,000 = YEN 129.0
Price Index (Year 1992 = 100)

In the above, the cost covered by the participation of farmers is estimated at 14 % of the costs for civil works.

20. Evaluation of the entire project package is made dealing the 340 schemes recommended to be implemented as one project. The project is expected to generate economic internal rates of return (EIRRs) of 12.0%, 17.2% and 16.5% for the land development scheme, the village irrigation scheme and overall project, respectively. At a 10 percent opportunity cost of capital, the project yields net present values (NPVs) of Rp. 1.0 billion from the land development scheme and Rp. 23.6 billion from the village irrigation scheme. B/Cs at the same discount rate are estimated respectively at 1.16 and 1.62 and for overall project at 1.55. All the EIRRs pass the test of the 10 percent cost of capital figure that is commonly applied in evaluating projects.
Sensitivity of project profitability is analyzed for the cases of cost increase and benefit decrease. 10 percent and 20 percent changes are assumed and the EIRRs are calculated as follows:

Increase in Cost	Decrease in Benefit 0%	10%	20%
0%	16.5%	14.8%	13.0%
10%	14.9%	13.3%	11.6%
20%	13.6%	12.1%	10.5%

The project still generates more than 10 percent of EIRR even in the worst case of 20 percent cost increase and benefits decrease. It is concluded that the project is economically sound against the unforeseen changes of the economy.

21. The major economic units affected by the project implementation include individual farm, farmers' organizations and the project executing agency. The farm budget analysis shows that the project will well better off every farm. Since economic viability is the key factor in selecting schemes to be implemented, selected schemes are those with higher returns. Thus farm income is expected to be higher.

The farmers' organization will be responsible for operation and maintenance of the irrigation facilities with the service fees and labor dedication from farmers. The organizations, however, are not profit seeking bodies and then their budget stability highly depends on farmers' capacity to pay service fees. An increase in farm income can well exceed the additional payment for operation and maintenance. Thus the organization budget will keep a balance as far as they successfully collect charges from farmers.

22. In Indonesia, LKMD (Village Development Committee) is organized in each village to discuss their village development under village administration. The chief of PKK (Women/Family Education Program at Village Level) is one of the member of this committee: LKMD as a representative of women group. In principle, village housewives have a channel to village development officially.

23. In 1989, Ministry of Public Works prepared a guidelines for environmental impact analysis management (AMDAL) procedure for projects including irrigation development projects in accordance with Government's Regulation No.29, 1986 concerning AMDAL. The guidelines stipulate followings:

1) The maintenance/rehabilitation of irrigation networks can be made without AMDAL, and

2) PIL (Presentation of Environmental Information) without AMDAL must be made in a new small scale irrigation scheme which development area is less than 2,000 ha.

The proposed schemes in this study belong to village irrigation scheme or small scale land development scheme which development area is far less than 2,000 ha. Generally, rehabilitation area or new land development area in each scheme is around 100 ha on average. Accordingly, much environmental impacts would not be expected with the implementation of the proposed schemes. It is recommended, however, to take following actions prior to their construction:

a) In village irrigation schemes, simple environmental checking will be made before their construction, and

b) In land development schemes, environmental information with project implementation will be collected and evaluated before their construction.

RECOMMENDATION

1. The project aims at accelerating the development of paddy field and improving irrigation system at small scale existing irrigation schemes with smaller investment up to present consisting of the schemes with necessity of land development and village irrigation schemes. To rehabilitate and upgrade the existing simple systems and to accelerate the development of introduction paddy fields at small scale irrigation schemes bear earlier occurrence of benefit and cheeper construction cost due to the participation of farmers than at large scale irrigation schemes, and bring farmers stable paddy cultivation and decrease of damages. In addition, the Project will contribute not only to the self-sufficiency of rice, but also to the raise of income and stable livelihood of farmers and the alleviation of poverty. Thus, the early implementation of the Project have been expected.

2. It is expected that the Project is implemented in three provinces where the feasibility study has been carried out, namely, North Sumatra, South Sulawesi and West Nusa Tenggara in the first stage and in five provinces where the inventory survey was carried out by the Indonesian side, that is, Ache, Lampung, Central Sulawesi, South East Sulawesi and East Nusa Tenggara in the second stage. Actually, however, it is desirable to do the additional inventory survey and the evaluation of the schemes already surveyed in the future in the later five provinces.

3. It is expected to examine the proper organization, recruiting of staff and budgetary arrangement for the preparation and implementation of the Project. Especially, it will be recommendable to establish a coordinating unit to play a role of a steering committee in the central Government because the cooperation between DGFCA and DGWRD is indispensable.

4. It is a prerequisite for farmers to bear a part of construction cost for the Project because the Project mainly aims at the development of paddy fields at the tertiary blocks in the existing irrigation schemes and the rehabilitation of village irrigation schemes operated and maintained by farmers. Accordingly, it is recommendable to examine the scope, contents,etc. of farmers' participation and burden.

Table 1 SUMMARY OF PROJECT COST

Unit : Million Rp.

Item	LD Schemes F/C	LD Schemes L/C	LD Schemes Total	VI Schemes F/C	VI Schemes L/C	VI Schemes Total	Project Cost F/C	Project Cost L/C	Project Cost Total
1. Preparatory Works	119	79	198	1,431	954	2,385	1,550	1,033	2,583
2. Civil Work									
2.1 Land Development	1,689	1,690	3,379	1,317	1,317	2,634	3,006	3,007	6,013
2.2 Intake & Canal Structure	1,751	1,750	3,501	14,902	14,902	29,804	16,653	16,652	33,305
3. Training & Demonstration	11	64	75	134	763	897	145	827	972
4. Institutional Strengthening	23	10	33	275	118	393	298	128	426
5. O&M Equipments	141	15	156	1,692	188	1,880	1,833	203	2,036
6. Land Acquisition		33	33		393	393		426	426
7. Administration		344	344		1,622	1,622		1,966	1,966
8. Consulting Services	600	151	751	7,219	1,805	9,024	7,819	1,956	9,775
Total(1-8)	4,334	4,136	8,470	26,970	22,062	49,032	31,304	26,198	57,502
9. Phisical Contingency	216	207	423	1,349	1,103	2,452	1,565	1,310	2,875
Total	4,550	4,343	8,893	28,319	23,165	51,484	32,869	27,508	60,377
10. Value Added Tax		852	852		4,947	4,947		5,799	5,799
11. Price Escalation		1,991	1,991		11,481	11,481		13,472	13,472
Grand Total	4,550	7,186	11,736	28,319	39,593	67,912	32,869	46,779	79,648

Price index : 1992=100

1Us$ = Rp.2,000 = ¥129.0

Table 2 PRINCIPAL FEATURES OF THE PROJECT

a. Objective Province	: North Sumatra	South Sulawesi	NTB	Total
b. Objective District	: 9 nos	16 nos	6 nos	31nos
	Asahan	Bantaeng	Lombok Barat	
	Dairi	Barru	Lombok Tengah	
	Deli Serdan	Bone	Lombok Timur	
	Karo	Bulkumba	Sumbawa	
	Labuhan Batu	Enrekang	Bima	
	Langkat	Gowa	Dompu	
	Tapanuli Sel.	Jeneponto		
	Tapanuli Tengah	Luwu		
	Tapanuli Utara	Mamuju		
		Maros		
		Polmas		
		Pare-pare		
		Sinjai		
		Soppeng		
		Tana Toraja		
		Wajo		
c. Project Components				
1. Land development				
2. Village irrigation development				
3. Institutional strengthening				
4. Strength of coordination and monitoring				
d. Number of Scheme	nos	nos	nos	nos
LD Scheme	: 23	5	2	30
VI Scheme	: 90	160	60	310
Total	: 113	165	62	340
e. Covering Area	ha	ha	ha	ha
LD Scheme	: 3,900	900	500	5,300
VI Scheme	: 9,300	32,200	25,300	66,800
Total	:13,200	33,100	25,800	72,100
f. Beneficiaries	household :17,400	19,100	12,300	48,800
g. Gross Paddy Field	ha	ha	ha	ha
Present Paddy	: 4,400	8,500	4,100	17,000
Future Paddy	: 9,700	14,500	6,200	30,400

Table 2 Continued

Objective Province	North Sumatra	South Sulawesi	NTB	Total
h. Net Paddy Field	ha	ha	ha	ha
Present Paddy	: 3,900	7,700	3,700	15,300
Future Paddy	: 8,700	13,100	5,500	27,300
i. Increase of Paddy Field	ha	ha	ha	ha
Gross Paddy	: 5,300	6,000	2,100	13,400
Net Paddy	: 4,800	5,400	1,800	12,000
j. Reclamation of New Paddy Field				
ID Scheme	: 1,928	261	145	2,334
VI Scheme	: 1,065	561	400	2,026
Total	2,993	822	545	4,360
k. Rainfed Paddy				
Present	: 2,900	10,300	2,400	15,600
Future	: 200	5,100	900	6,200
l. Palawija				
Present	: 1,100	5,900	6,600	13,600
Future	: 500	5,300	6,300	12,100
m. Orchard/Plantation				
Present	: 400	1,900	1,400	3,700
Future	: 300	1,900	1,400	3,600
n. Yield of Paddy	t/ha	t/ha	t/ha	
Present	: 2.87	3.33	3.38	
Future	: 3.88	4.29	4.33	
o. Production of Paddy	ton	ton	ton	ton
Present Paddy	:22,400	61,500	21,800	105,700
Future Paddy	:55,700	100,900	35,900	192,500
Increase	:33,300	39,400	14,100	86,800
p. Construction Cost	:		39,318 million Rp.	
Ha Cost	:		647 us$/ha	
Burden of Farmers	:		5,504 million Rp.	
q. Construction Period	:		7 years	
r. Project Cost	:		79,648 million Rp.	
Ha Cost			1,310 US$/ha	
s. EIRR	:		16.5 %	
t. B/C	:		1.55	

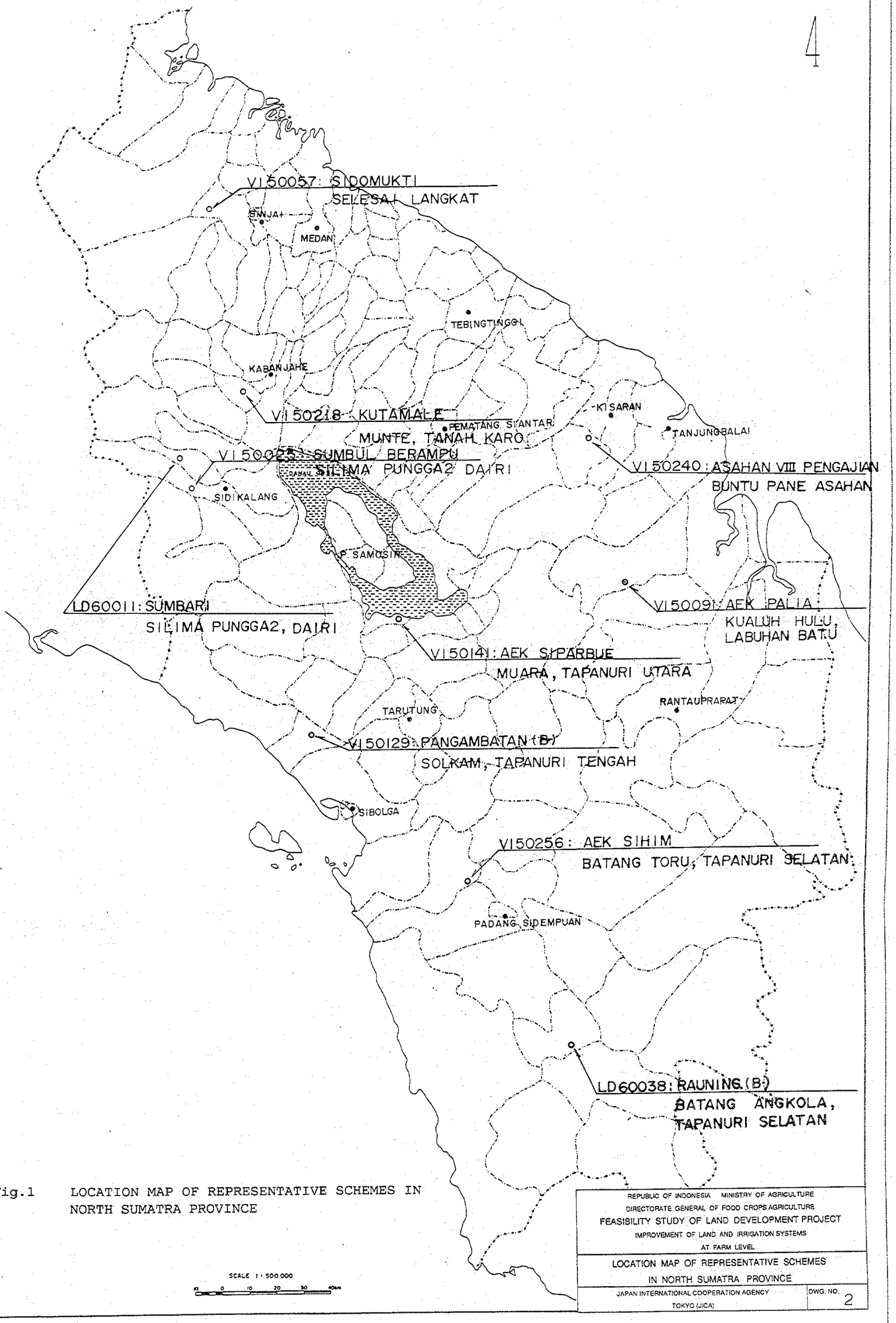


Fig.1 LOCATION MAP OF REPRESENTATIVE SCHEMES IN NORTH SUMATRA PROVINCE

REPUBLIC OF INDONESIA MINISTRY OF AGRICULTURE DIRECTORATE GENERAL OF FOOD CROPS AGRICULTURE FEASIBILITY STUDY OF LAND DEVELOPMENT PROJECT IMPROVEMENT OF LAND AND IRRIGATION SYSTEMS AT FARM LEVEL	
LOCATION MAP OF REPRESENTATIVE SCHEMES IN NORTH SUMATRA PROVINCE	
JAPAN INTERNATIONAL COOPERATION AGENCY TOKYO (JICA)	DWG. NO. 2

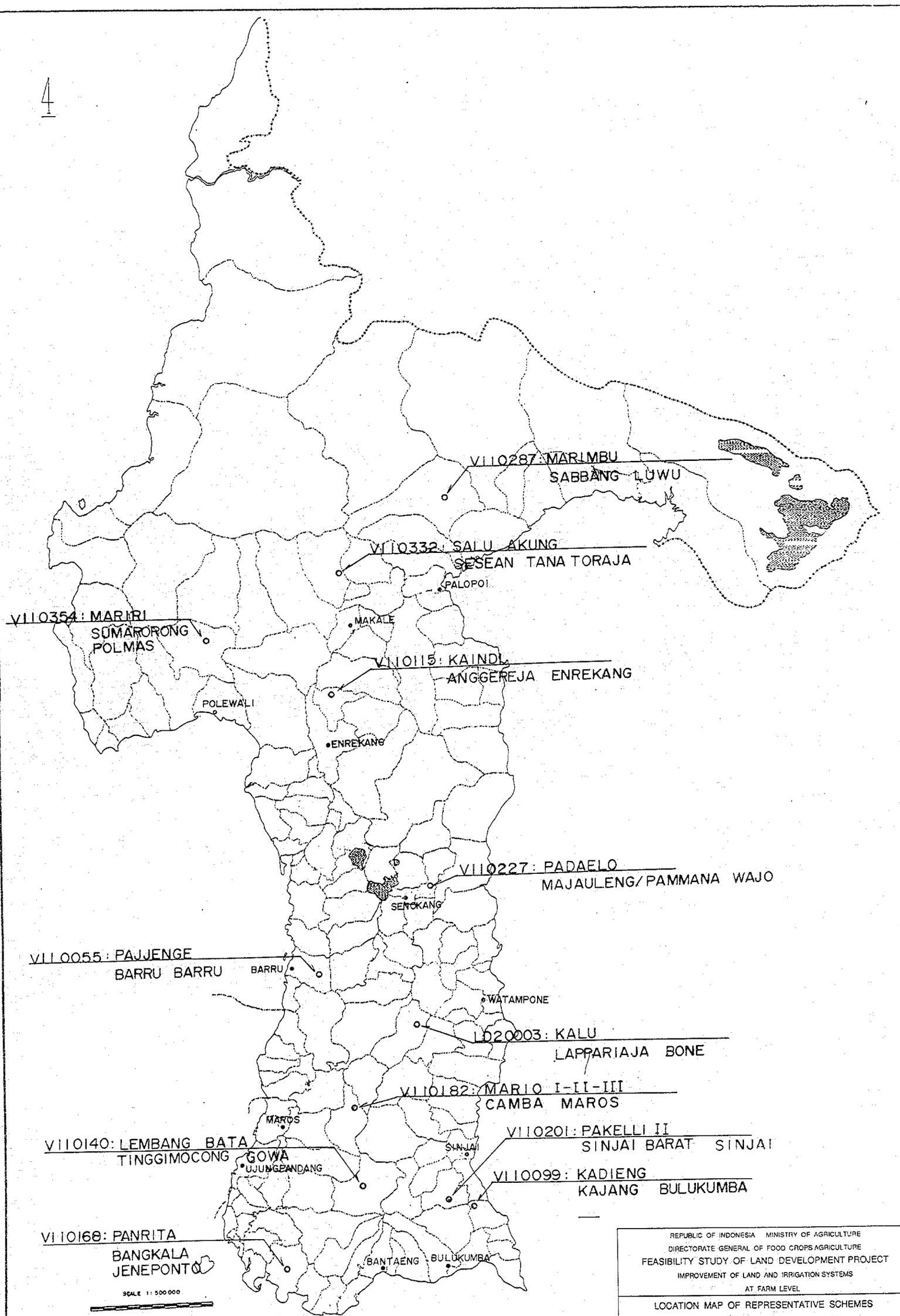
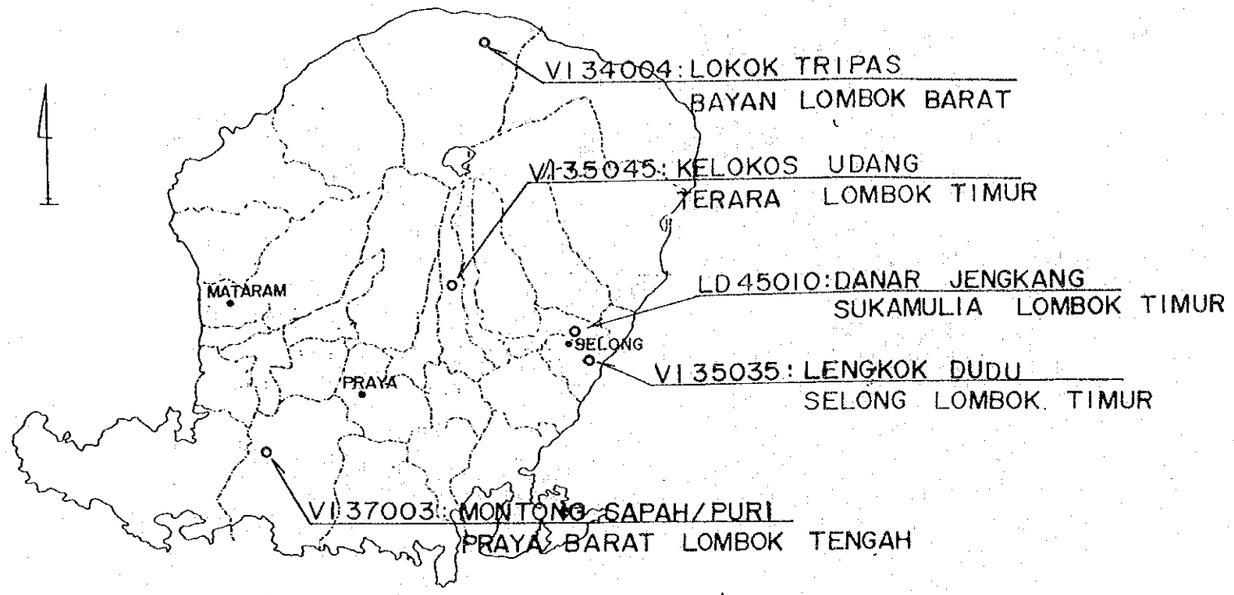
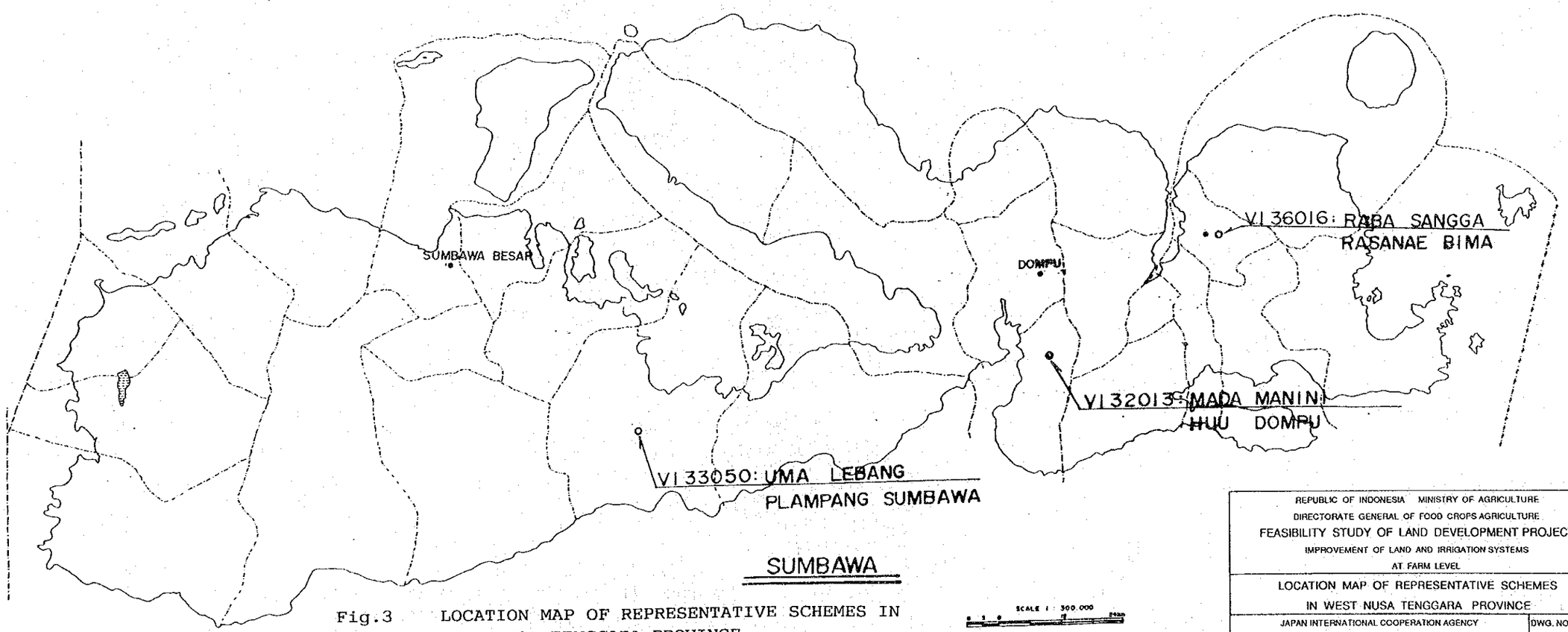


Fig.2 LOCATION MAP OF REPRESENTATIVE SCHEMES IN SOUTH SULAWESI PROVINCE

REPUBLIC OF INDONESIA MINISTRY OF AGRICULTURE
DIRECTORATE GENERAL OF FOOD CROPS AGRICULTURE
FEASIBILITY STUDY OF LAND DEVELOPMENT PROJECT
IMPROVEMENT OF LAND AND IRRIGATION SYSTEMS AT FARM LEVEL
LOCATION MAP OF REPRESENTATIVE SCHEMES IN SOUTH SULAWESI PROVINCE
JAPAN INTERNATIONAL COOPERATION AGENCY TOKYO (JICA) — DWG. NO. 3



LOMBOK



SUMBAWA

Fig.3 LOCATION MAP OF REPRESENTATIVE SCHEMES IN WEST NUSA TENGGARA PROVINCE

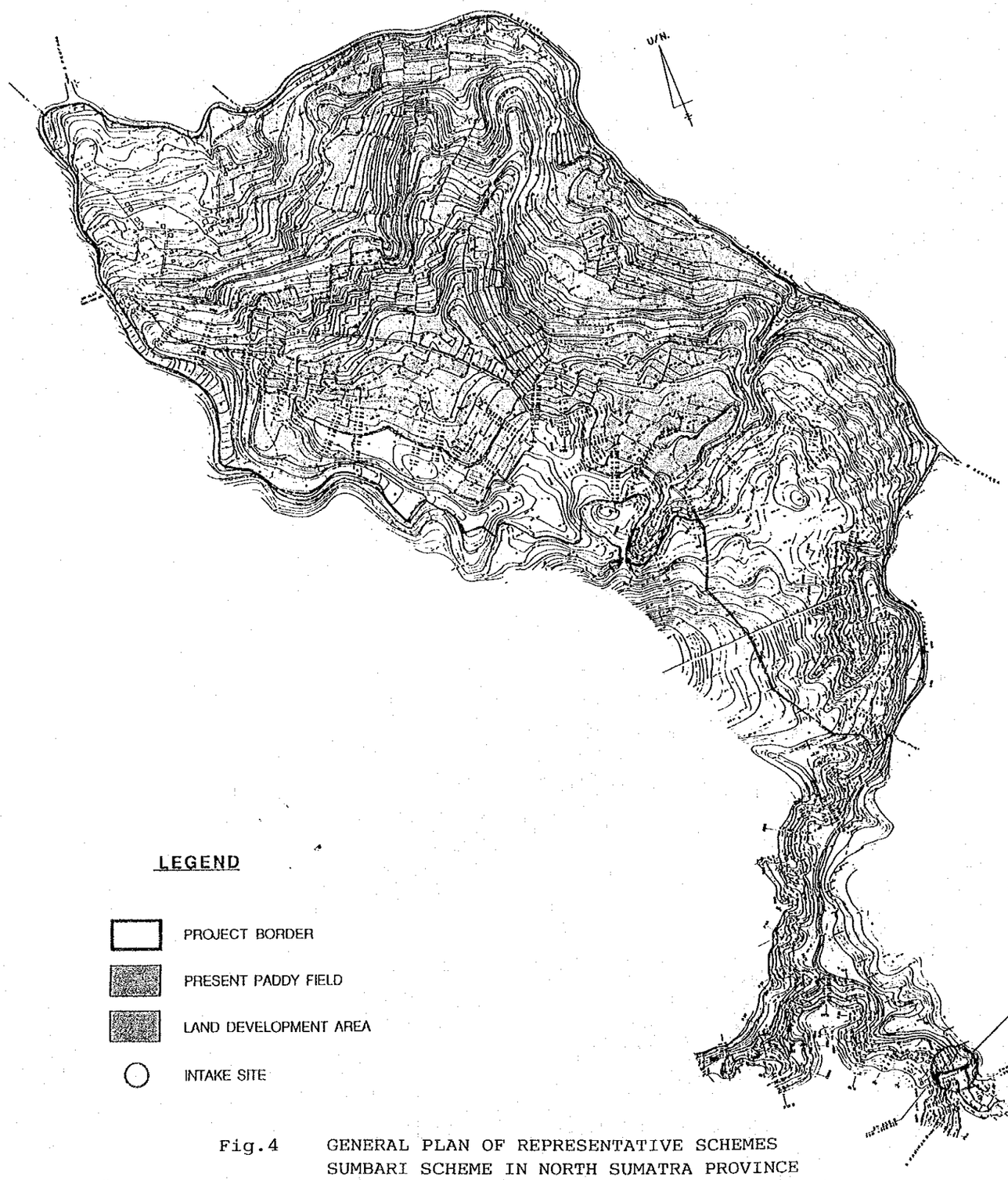
SCALE 1 : 300.000

REPUBLIC OF INDONESIA MINISTRY OF AGRICULTURE
DIRECTORATE GENERAL OF FOOD CROPS AGRICULTURE
FEASIBILITY STUDY OF LAND DEVELOPMENT PROJECT
IMPROVEMENT OF LAND AND IRRIGATION SYSTEMS AT FARM LEVEL

LOCATION MAP OF REPRESENTATIVE SCHEMES IN WEST NUSA TENGGARA PROVINCE

JAPAN INTERNATIONAL COOPERATION AGENCY TOKYO (JICA)

DWG. NO. 4



LEGEND

- PROJECT BORDER
- PRESENT PADDY FIELD
- LAND DEVELOPMENT AREA
- INTAKE SITE

Fig.4 GENERAL PLAN OF REPRESENTATIVE SCHEMES
SUMBARI SCHEME IN NORTH SUMATRA PROVINCE

LEGENDA
LEGEND

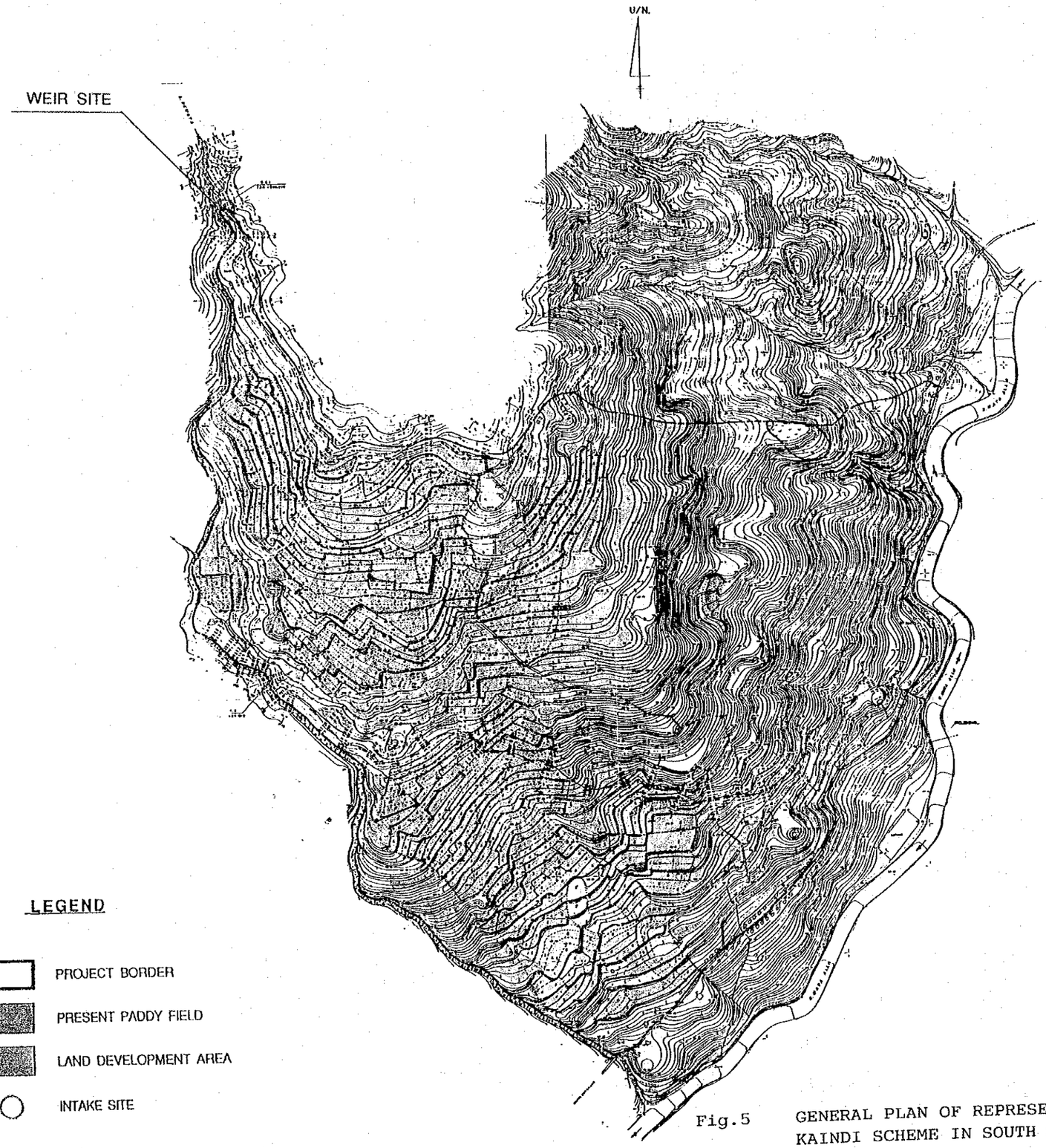
Contour line / Garis ketinggian
Flow direction / Arah Aliran
River / Sungai
Secondary canal / Anak sungai
Domaire / Batas desa
Road / Jalan
Jalan setapak
Bridge / Jembatan beton/batu
Canal / Saluran air
Bench Mark / Titik tinggi tetap
School / Sekolah
Kepala penerangan
House / Rumah
Mosque / Mesjid
Cassa / Kelapa
Kelapa sawit
Rubber plantation / Karet
Rice field / Sawah
Swamp / Rawa
Cemetery / Kuburan islam
Grassland / Alang-alang

SCALA / SKALA
0 100 200 300 400 500m
1 : 5000

REPUBLIC OF INDONESIA MINISTRY OF AGRICULTURE
DIRECTORATE GENERAL OF FOOD CROPS AGRICULTURE
FEASIBILITY STUDY OF LAND DEVELOPMENT PROJECT
IMPROVEMENT OF LAND AND IRRIGATION SYSTEMS AT FARM LEVEL

GENERAL PLAN OF REPRESENTATIVE SCHEMES
SCHEME: SUMBARI PROVINCE: NORTH SUMATRA

JAPAN INTERNATIONAL COOPERATION AGENCY TOKYO (JICA)
DWG. NO. 8



LEGEND
LEGENDA

- Contour line / Garis ketinggian
- School / Sekolah
- Transmission point / Titik pengaman
- Road / Jalan
- Houses / Rumah
- Mosque / Mesjid
- River / Sungai
- Canal / Saluran
- Flow direction / Arah aliran
- Rice field / Sawah
- Culvert / Gorong gorong
- Coconut trees / Pohon kelapa
- Non irrigated farming / Ladang
- Horticulture / Tegalan
- Mixed agriculture / Kebun campuran
- Waterpump / Pompa air

SCALA / SKALA
0 100 200 300 400 500m
1 : 5000

REPUBLIC OF INDONESIA MINISTRY OF AGRICULTURE
DIRECTORATE GENERAL OF FOOD CROPS AGRICULTURE
FEASIBILITY STUDY OF LAND DEVELOPMENT PROJECT
IMPROVEMENT OF LAND AND IRRIGATION SYSTEMS AT FARM LEVEL

GENERAL PLAN OF REPRESENTATIVE SCHEMES
SCHEME: KAINDI PROVINCE: SOUTH SULAWESI

JAPAN INTERNATIONAL COOPERATION AGENCY TOKYO (JICA)
DWG. NO. 22

Fig.5 GENERAL PLAN OF REPRESENTATIVE SCHEMES KAINDI SCHEME IN SOUTH SULAWESI PROVINCE

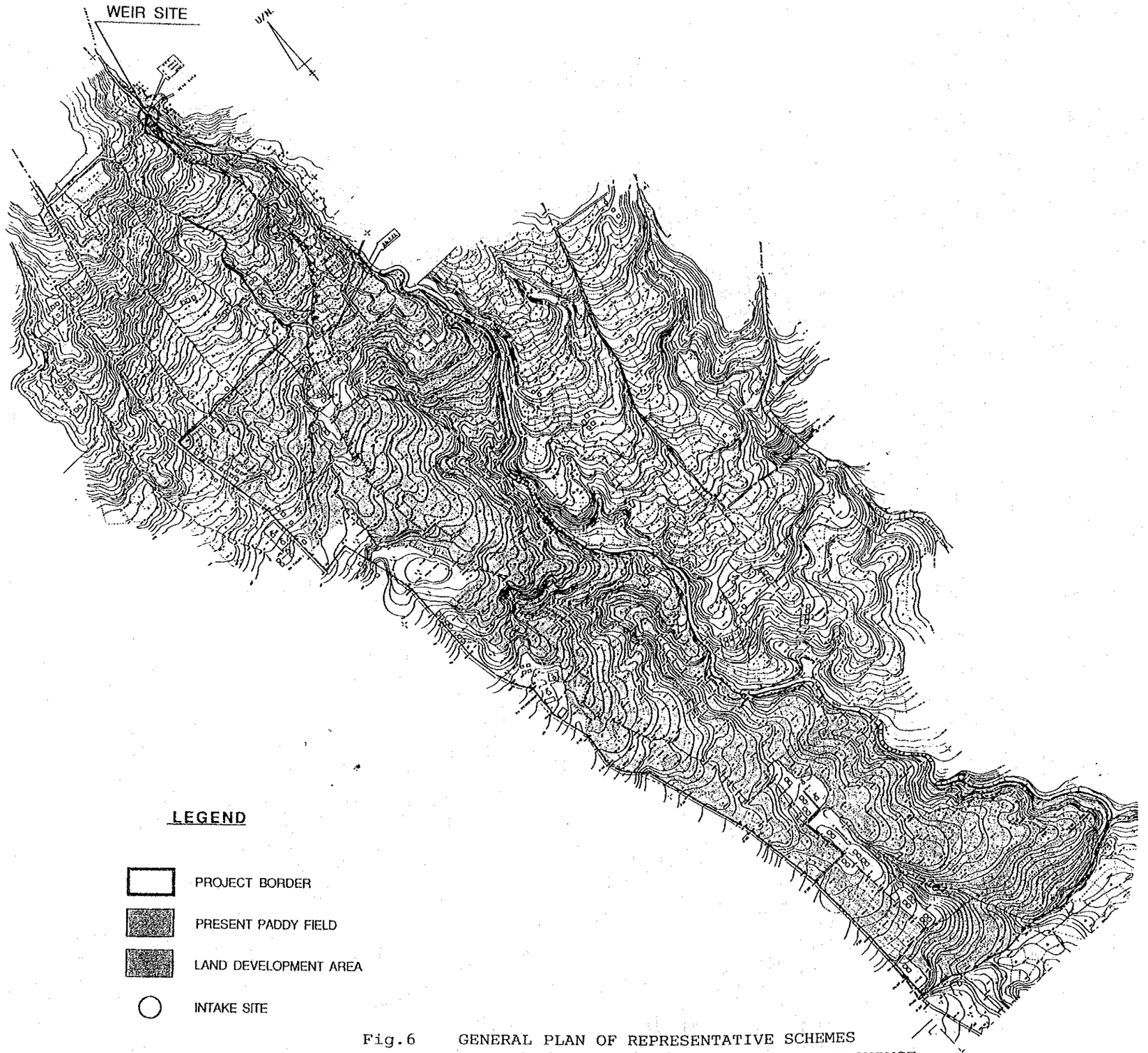


Fig.6 GENERAL PLAN OF REPRESENTATIVE SCHEMES
KELOKOS UDANG IN WEST NUSA TENGGARA PROVINCE

LEGENDA / LEGEND

COORDINATE POINT
- TITIK KOORDINAT (X,Y) DAN IP / SPOT HEIGHT
- TITIK KETINGGIAN / BENCH MARK

BANGUNAN / STRUCTURE
- RUMAH / HOUSING
- KANTOR PEMERINTAHAN / GOVERNMENT OFFICE
- KANTOR POLISI / POLICE OFFICE
- KANTOR POS / POST OFFICE
- SEKOLAH / SCHOOL
- RUMAH SAKIT / HOSPITAL
- MASJID / MOSQUE
- GEREJA/KELENTENG / CHURCH
- PABRIK / FACTORY
- PUSAT LISTRIK TENAGA AIR / HYDRO POWER STATION
- PASAR / MARKET
- TEMPAT POMPA AIR / WATER PUMP STATION

JALAN
- JALAN > 2 m
- JALAN 1 – 2 m
- JALAN SETAPAK / JETTY ROAD
- JALAN SEDANG DIBANGUN / UNDER CONSTRUCTION ROAD
- BAGIAN JALAN GALIAN
- BAGIAN JALAN TIMBUNAN
- JEMBATAN BATU/BESI / STONE/STEEL BRIDGE
- JEMBATAN BAMBU / BAMBOO BRIDGE
- GORONG-GORONG PEMBUANG / SEWERAGE CULVERT

PLANTATION
- BATAS TANAMAN / BOUNDARY PLANTATION
- SAWAH / PADDY FIELD
- LADANG/KEBUN / UPLAND FIELD
- BUAH-BUAHAN / FIELD OF FRUIT
- KELAPA / COCONUT FIELD
- KARET / RUBBER FIELD
- LADA / PEPPER FIELD
- HUTAN BELUKAR / FOREST
- ALANG-ALANG / GRASS
- SOIL PIT

PERAIRAN
- ARAH ARUS / DISCHARGE DIRECTLY
- SUNGAI DAN ANAK SUNGAI / RIVER & TRIBUTARY
- SALURAN AIR / CANAL
- TALUD / LEVEE
- BENDUNGAN / WEIR
- PINTU AIR / GATE WEIR
- RAWA / SWAP

RELIEF
- GARIS SAMA TINGGI / CONTOUR
- INDEKS GARIS SAMA TINGGI / INDEX CONTOUR
- CLIFF OR ESCARPENT
- SUSUR CURAM
- GARIS SAMA TINGGI DEPRESI
- TEBING BERBATU
- LEKENG TERKROSI

SCALA / SKALA
0 100 200 300 400 500m
1 : 5000

REPUBLIC OF INDONESIA MINISTRY OF AGRICULTURE
DIRECTORATE GENERAL OF FOOD CROPS AGRICULTURE
FEASIBILITY STUDY OF LAND DEVELOPMENT PROJECT
IMPROVEMENT OF LAND AND IRRIGATION SYSTEMS AT FARM LEVEL

GENERAL PLAN OF REPRESENTATIVE SCHEMES
SCHEME: KELOKOS UDANG PROVINCE: WEST NUSA TENGGARA

JAPAN INTERNATIONAL COOPERATION AGENCY TOKYO (JICA)
DWG. NO. 39

LEGEND

SI	IRRIGATED PADDY FIELD SAWAH IRIGASI
SH	RAINFED PADDY FIELD SAWAH TADAH HUJAN
Tg	UPLAND FIELD TEGALAN / LADANG
MA	MIXED AGRICULTURE KEBUN CAMPURAN
PL	PLANTATION (r = Rubber, op = Oil Palm) PERKEBUNAN (r = Karet, op = Kelapa Sawit)
SA	GRASS LAND SEMAK / ALANG-ALANG
HR	LIGHT FOREST HUTAN RINGAN
HB	UNDER BUSH HUTAN BELUKAR
HJ	TEAK FOREST HUTAN JATI
FP	FISH POND KOLAM IKAN
Ka	VILLAGE KAMPUNG
R	SWAMP RAWA

PLANNED IRRIGATED PADDY FIELD
RENCANA SAWAH IRIGASI

Fig.7 LAND USE MAP, SUMBARI SCHEME

LEGENDA
LEGEND

Contour line
Garis ketinggian

Flow direction
Arah Aliran

River
Sungai

Secondary road
Jalan sungai

Demarcation
Batasan

Road
Jalan

Jalan setapak

Bridge
Jembatan satu/dua

Canal
Saluran

Beach Mark
Titik tinggi tetap

School
Sekolah

Kantor pemerintahan

House
Rumah

Mosque
Mesjid

Church
Gereja

Kebun sawit

Rubber plantation
Karet

Abandoned
Bekas

Swamp
Rawa

Cemetery
Kuburan/pekuburan

Grassland
Alang-alang

SCALA / SKALA
0 100 200 300 400 500m

REPUBLIC OF INDONESIA MINISTRY OF AGRICULTURE
DIRECTORATE GENERAL OF FOOD CROPS AGRICULTURE

FEASIBILITY STUDY OF LAND DEVELOPMENT PROJECT
IMPROVEMENT OF LAND AND IRRIGATION SYSTEMS AT FARM LEVEL

LAND USE MAP

SCHEME: SUMBARI PROVINCE: NORTH SUMATRA

JAPAN INTERNATIONAL COOPERATION AGENCY
TOKYO (JICA)

DWG. NO. 45

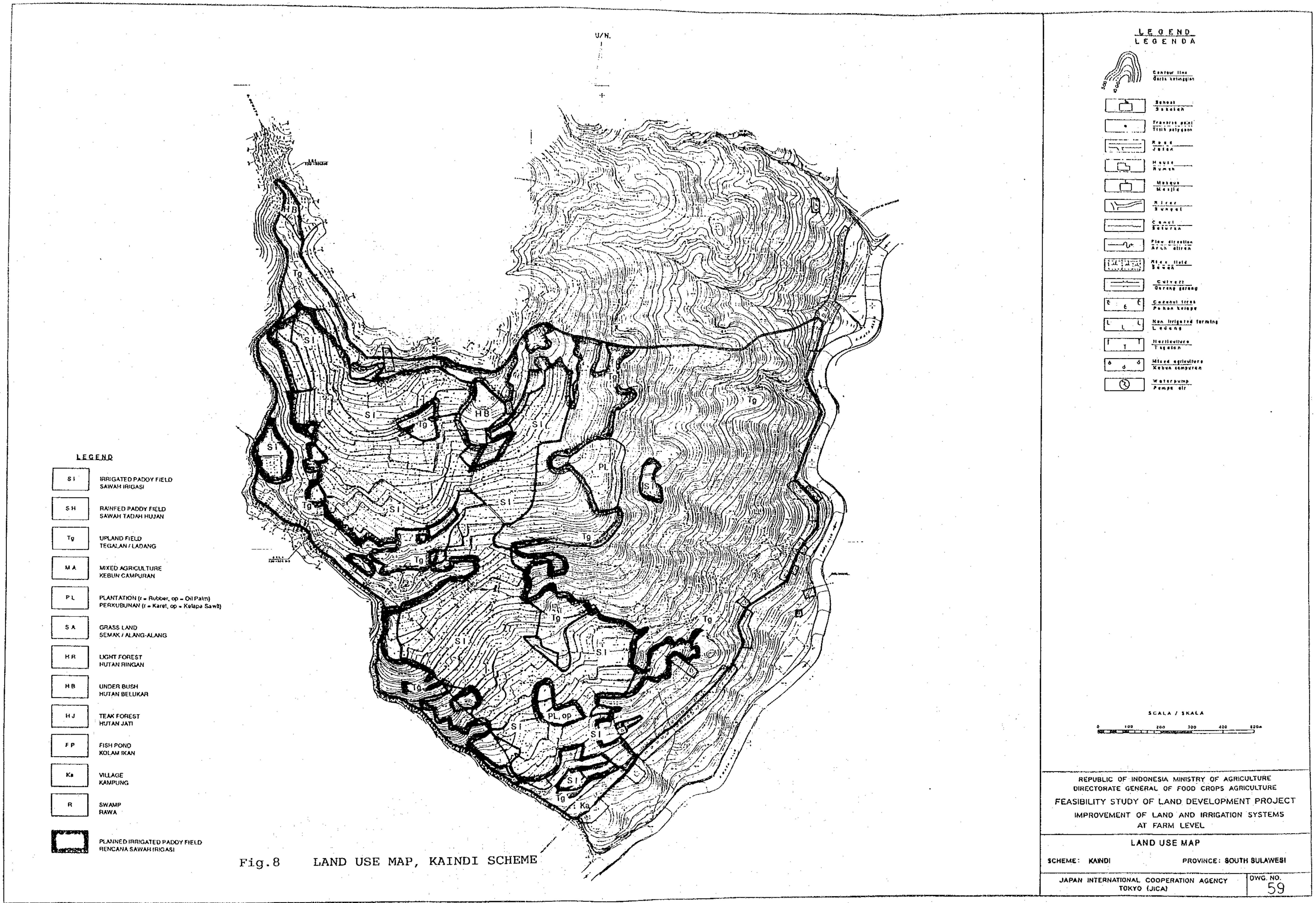
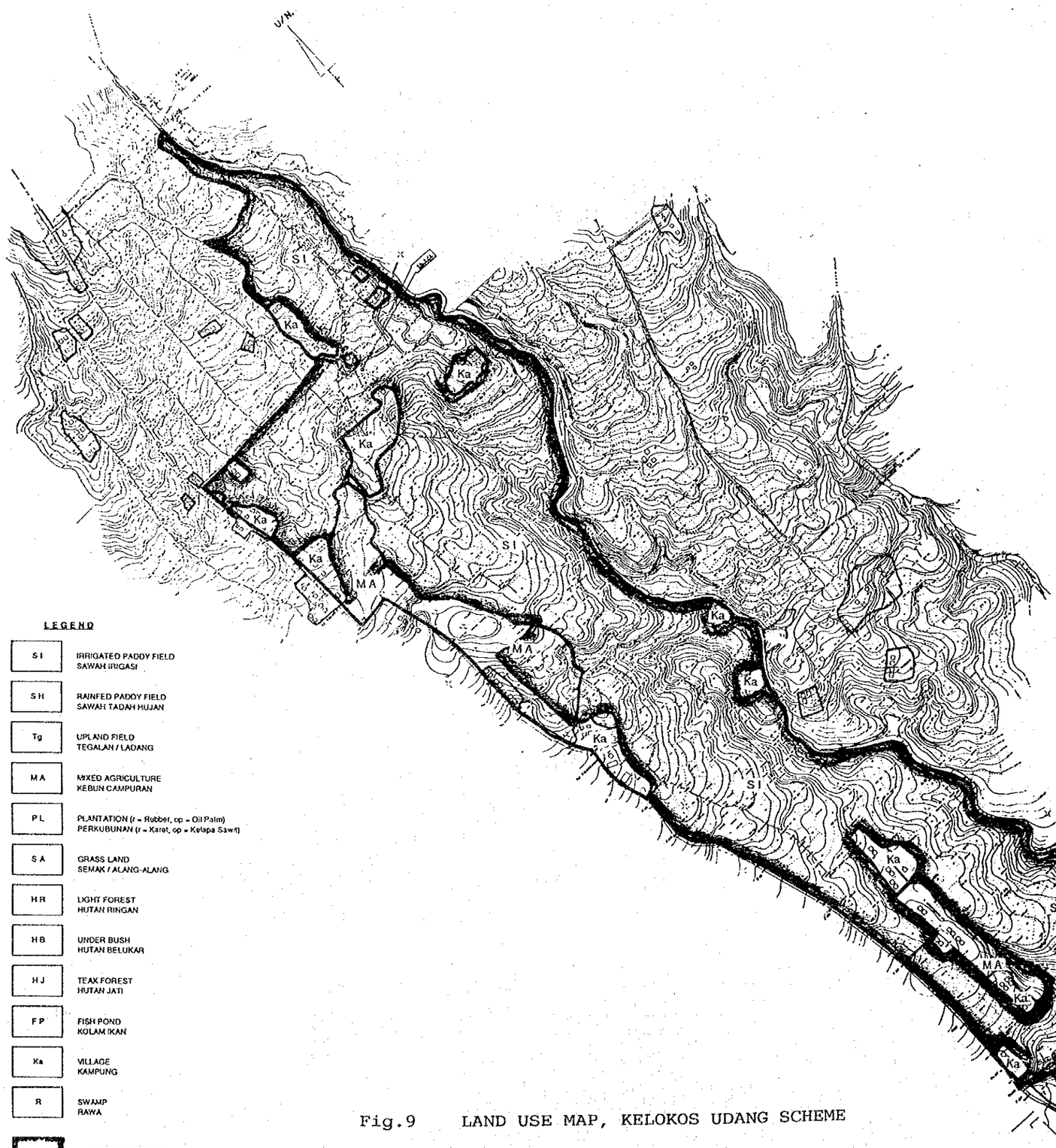


Fig.8 LAND USE MAP, KAINDI SCHEME



LEGEND

SI	IRRIGATED PADDY FIELD SAWAH IRIGASI
SH	RAINFED PADDY FIELD SAWAH TADAH HUJAN
Tg	UPLAND FIELD TEGALAN / LADANG
MA	MIXED AGRICULTURE KEBUN CAMPURAN
PL	PLANTATION (r = Rubber, op = Oil Palm) PERKUBUNAN (r = Karet, op = Kelapa Sawit)
SA	GRASS LAND SEMAK / ALANG-ALANG
HR	LIGHT FOREST HUTAN RINGAN
HB	UNDER BUSH HUTAN BELUKAR
HJ	TEAK FOREST HUTAN JATI
FP	FISH POND KOLAM IKAN
Ka	VILLAGE KAMPUNG
R	SWAMP RAWA

PLANNED IRRIGATED PADDY FIELD
RENCANA SAWAH IRIGASI

Fig.9 LAND USE MAP, KELOKOS UDANG SCHEME

LEGENDA
LEGEND

COORDINATE POINT

- TITIK IKAT KOORDINAT (X,Y) DAN TP SPOT HEIGHT
- TITIK KETINGGIAN BENCH MARK

BANGUNAN STRUCTURE

- RUMAH HOUSING
- KANTOR PEMERINTAHAN GOVERNMENT OFFICE
- KANTOR POLISI POLICE OFFICE
- KANTOR POS POST OFFICE
- SEKOLAH SCHOOL
- RUMAH SAKIT HOSPITAL
- MASJID MOSQUE
- GEREJA/KELENTENG CHURCH
- PABRIK FACTORY
- PUSAT LISTRIK TENAGA AIR HYDRO POWER STATION
- PASAR MARKET
- TEMPAT POMPA AIR WATER PUMP STATION

JALAN

- JALAN > 2 m
- JALAN 1 – 2 m
- JALAN SETAPAK JETTY ROAD
- JALAN SEDANG DIBANGUN UNDER CONSTRUCTION ROAD
- BAGIAN JALAN GALIAN
- BAGIAN JALAN TIMBUNAN
- JEMBATAN BATU/BESI STONE/STEEL BRIDGE
- JEMBATAN BAMBU BAMBOO BRIDGE
- GORONG-GORONG PEMBUANG SEWERAGE CULVERT

PLANTATION

- BATAS TANAMAN BOUNDARY PLANTATION
- SAWAH PADDY FIELD
- LADANG/KEBUN UPLAND FIELD
- BUAH-BUAHAN FIELD OF FRUIT
- KELAPA COCONUT FIELD
- KARET RUBBER FIELD
- LADA PEPPER FIELD
- HUTAN BELUKAR FOREST
- ALANG-ALANG GRASS
- SOIL PIT

PERAIRAN

- ARAH ARUS DISCHARGE DIRECTLY
- SUNGAI DAN ANAK SUNGAI RIVER & TRIBUTARY
- SALURAN AIR CANAL
- TALUD LEVEE
- BENDUNGAN WEIR
- PINTU AIR GATE WEIR
- RAWA SWAP

RELIEF

- GARIS SAMA TINGGI CONTOUR
- INDEKS GARIS SAMA TINGGI INDEX CONTOUR
- CLIFF OR ESCARPENT
- SUSUR CURAM
- GARIS SAMA TINGGI DEPRESI
- TEBING BERBATU
- LERENG TERJAL

SCALA / SKALA

0 100 200 300 400 500m

REPUBLIC OF INDONESIA MINISTRY OF AGRICULTURE
DIRECTORATE GENERAL OF FOOD CROPS AGRICULTURE

FEASIBILITY STUDY OF LAND DEVELOPMENT PROJECT
IMPROVEMENT OF LAND AND IRRIGATION SYSTEMS AT FARM LEVEL

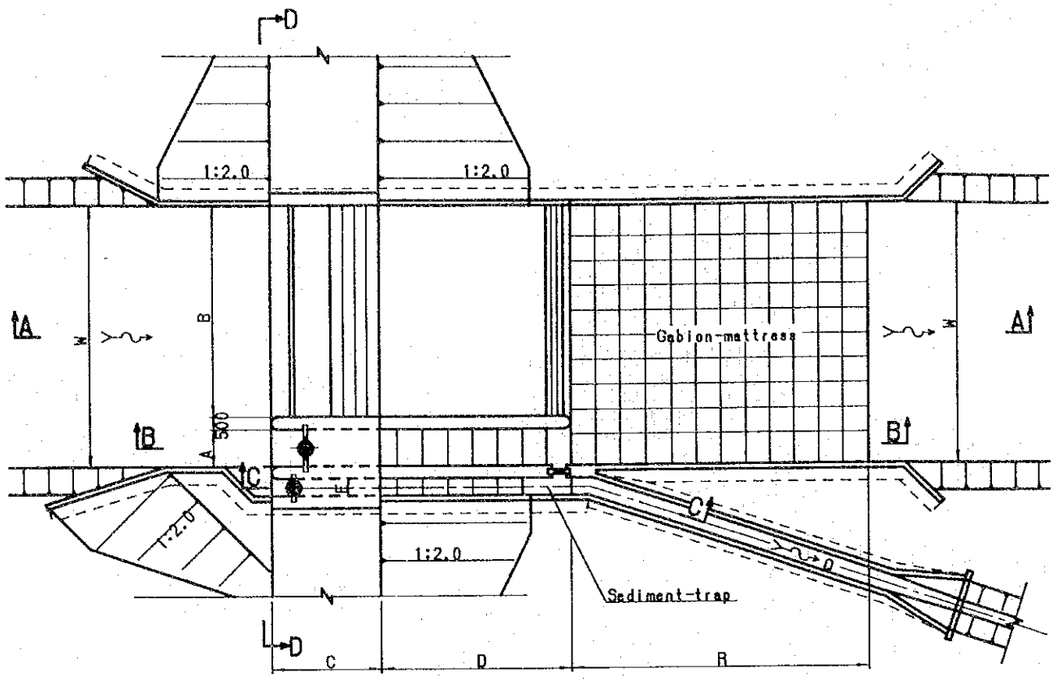
LAND USE MAP

SCHEME KELOKOS UDANG PROVINCE : WEST NUSA TENGGARA

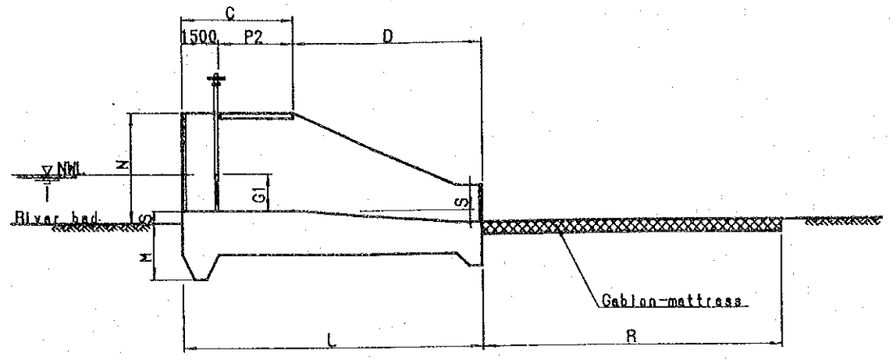
JAPAN INTERNATIONAL COOPERATION AGENCY TOKYO (JICA)

DWG. NO. 76

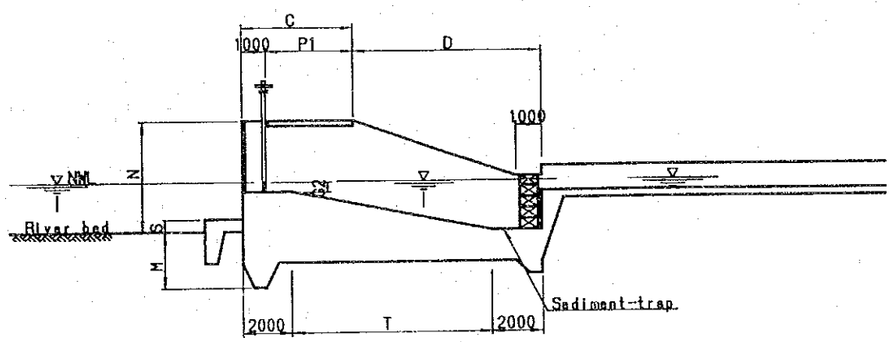
PLAN



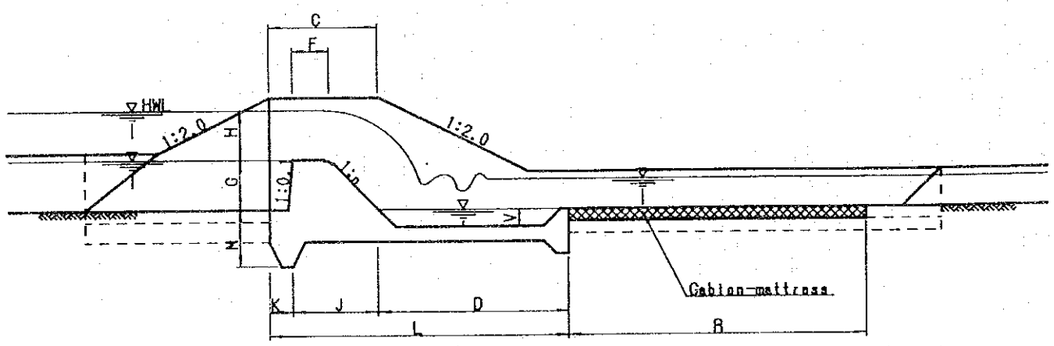
SECTION B-B



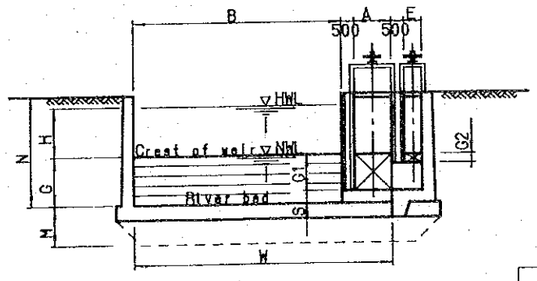
SECTION C-C



SECTION A-A



SECTION D-D



THIS DRAWING IS THE RESULT OF PRELIMINARY DESIGN AND IS FOR COST ESTIMATION ONLY AND SHOULD NOT BE USED FOR CONSTRUCTION

DIMENSION OF WEIR

Remarks: River width(w) shown in this drawing is a representative one as an example.

W(m)	B(m)	A(m)	G(m)	H(m)	C(m)	D(m)	F(m)	1:n	J(m)	K(m)	L(m)	R(m)	V(m)	M(m)	N(m)	P1(m)	P2(m)	T(m)	S(m)	G1(m)	Q (m3/s)	E(m)	G2(m)
10.50	8.50	1.50	1.00	1.00	2.15	5.40	1.05	0.6	1.65	0.50	7.55	3.00	0.30	1.30	2.50	1.15	0.65	3.55	0.25	0.75	0.500	1.30	1.00
10.50	8.50	1.50	1.00	1.50	2.55	5.40	1.25	0.8	2.05	0.50	7.95	6.00	0.30	1.30	3.00	1.55	1.05	3.95	0.25	0.75	0.450	1.30	0.90
10.50	8.50	1.50	1.00	2.00	3.00	5.40	1.50	1.0	2.50	0.50	8.40	8.00	0.30	1.30	3.50	2.00	1.50	4.40	0.25	0.75	0.400	1.30	0.80
10.50	8.50	1.50	1.50	1.00	2.70	6.65	1.05	0.6	1.95	0.75	9.35	4.00	0.50	1.50	3.00	1.70	1.20	5.35	0.35	1.15	0.350	1.20	0.75
10.50	8.50	1.50	1.50	1.50	3.25	6.65	1.30	0.8	2.50	0.75	9.90	7.00	0.50	1.50	3.50	2.25	1.75	5.90	0.35	1.15	0.300	1.10	0.70
10.50	8.50	1.50	1.50	2.00	3.75	6.65	1.50	1.0	3.00	0.75	10.40	10.00	0.50	1.50	4.00	2.75	2.25	6.40	0.35	1.15	0.250	1.10	0.60
10.50	8.50	1.50	2.00	1.00	3.50	7.65	1.30	0.6	2.50	1.00	11.15	4.00	0.70	2.30	3.50	2.50	2.00	7.15	0.50	1.50	0.200	1.00	0.50
10.50	8.50	1.50	2.00	1.50	3.90	7.65	1.30	0.8	2.90	1.00	11.55	8.00	0.70	2.30	4.00	2.90	2.40	7.55	0.50	1.50	0.150	0.90	0.45
10.50	8.50	1.50	2.00	2.00	4.50	7.65	1.50	1.0	3.50	1.00	12.15	12.00	0.70	2.30	4.50	3.50	3.00	8.15	0.50	1.50	0.100	0.70	0.40

Fig.10 STANDARD DESIGN OF WEIR

REPUBLIC OF INDONESIA MINISTRY OF AGRICULTURE
DIRECTORATE GENERAL OF FOOD CROPS AGRICULTURE
FEASIBILITY STUDY OF LAND DEVELOPMENT PROJECT
IMPROVEMENT OF LAND AND IRRIGATION SYSTEMS AT FARM LEVEL

STANDARD DESIGN OF WEIR

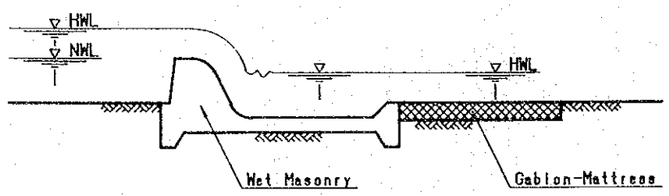
SCHEME: PROVINCE:

JAPAN INTERNATIONAL COOPERATION AGENCY TOKYO (JICA)

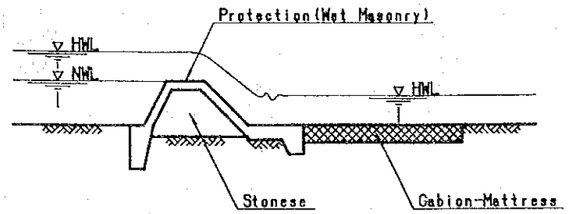
DWG.NO. 79

STANDARD OF WEIR SECTION

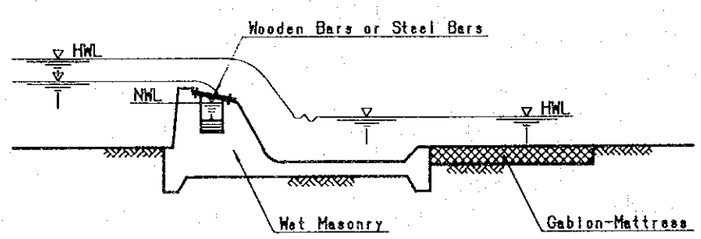
WET MASONRY TYPE



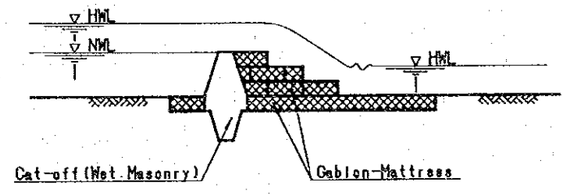
PROTECT TYPE



TYROLLER TYPE



MASONRY CUT-OFF AND GABION TYPE



GABION TYPE

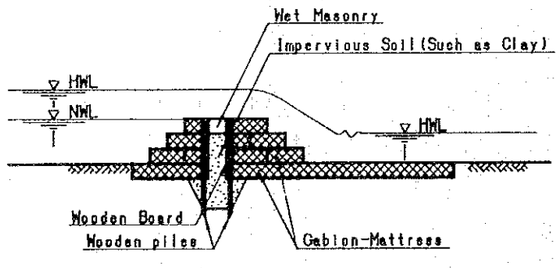


Fig.11 STANDARD OF WEIR SECTION

REPUBLIC OF INDONESIA MINISTRY OF AGRICULTURE
DIRECTORATE GENERAL OF FOOD CROPS AGRICULTURE
FEASIBILITY STUDY OF LAND DEVELOPMENT PROJECT
IMPROVEMENT OF LAND AND IRRIGATION SYSTEMS
AT FARM LEVEL

STANDARD OF WEIR SECTION

SCHEME: PROVINCE:

JAPAN INTERNATIONAL COOPERATION AGENCY
TOKYO (JICA)

DWG.NO. 80

Fig.12 IMPLEMENTATION SCHEDULE FOR THE PROJECT

I T E M	(QUANTITY)	1992	1993	1994	1995	1996	1997	1998	1999	2000
Loan Period										
I. Preparation										
1.1 Preparation of I/P										
1.2 Appraisal										
1.3 Loan Agreement				△						
1.4 Selection of Consultants										
1.5 Project Coordination										
II. Project Works										
2.1 Preparatory Works										
(1) Office arrangements	Central & Provinces									
(2) Survey and Investigation	30,400 ha									
2.2 Civil Works(North Sumatra, South Sulawesi, NTB Province)										
(1) Land Development	2,300 ha									
a. Assembling of farmer's groups	30 Groups									
b. Detailed design	30 Schemes									
c. Rehabilitation & Extension of facilities	2,300 ha									
d. Land clearing / levelling	2,300 ha									
e. Formatting, etc.	2,300 ha									
(2) Village Irrigation Development	28,100 ha									
a. Assembling of farmer'sgroups	310 Groups									
b. Detailed design	310 Schemes									
c. Rehabilitation & Extension of on-farm facilities	28,100 ha									
d. Land clearing / levelling	2,000 ha									
e. Formatting, etc.	2,000 ha									
2.3 Training	1 L.S									
2.4 Post Evaluation	340 Schemes									