

Table I-2-12 Agriculture in Peat/Acid Surface Soil

F/S area	If you or family settle in peat land, what is main activity?			New settlement project is successful?	
	Agriculture (%)	Agri-labor (%)	Livestock (%)	Yes (%)	No (%)
Bacho	85.8	6.8	49.6	71.9	28.1
Kab Daeng	62.3	2.1	31.9	60.0	12.5
Muno-Khoknai	64.0	0.0	54.6	61.7	19.1

Table I-2-13 Other Cash Cost

F/S area	Buffalo rent (Baht)		Hired pump (Baht)		Fuel & oil (Baht)	
	Paddy	Vegetable	Paddy	Vegetable	Paddy	Vegetable
Bacho	0.0	0.0	0.0	0.0	273.9	69.8
Kab Daeng	0.0	0.0	0.0	0.0	241.5	119.5
Nuno Khknai	0.00	0.00	7.6	0.0	529.1	28.4

F/S area	Water charge (Baht)		Others (Baht)	
	Paddy	Vegetable	Paddy	Vegetable
Bacho	0.0	0.0	29.0	0.0
Kab Daeng	0.0	0.0	0.0	43.4
Nuno Khknai	0.0	0.0	137.6	47.6

Table I-2-14 Marketing

1) Paddy

F/S area	Place of sales				Payment received				Buyers				Problem in Marketing										
	Farm (%)	Village market (%)	Amphoe market (%)	Changwat market (%)	Other (%)	Cash (%)	Credit (%)	Loan reduction (%)	Other (%)	Consumer (%)	Merchant (%)	Processor (%)	Coop (%)	Gov. (%)	Other (%)	Price fluctuation (%)	Price low (%)	Weight cheated (%)	No market (%)	No transportation (%)	No problem (%)	Other (%)	
																							Other (%)
Bacho	10.0	0.0	0.0	0.0	0.0	10.0	0.0	0.0	0.0	10.0	0.0	0.0	0.0	0.0	0.0	10.0	10.0	0.0	0.0	0.0	0.0	10.0	0.0
Kab Daebg	0.0	25.0	0.0	0.0	0.0	25.0	0.0	0.0	0.0	12.5	18.8	0.0	0.0	0.0	0.0	25.0	12.5	0.0	0.0	0.0	0.0	0.0	0.0
Muro Khoknai	28.6	60.7	5.4	0.0	5.3	0.0	0.0	0.0	0.0	60.7	59.3	0.0	0.0	0.0	0.0	63.0	39.3	0.0	0.0	0.0	0.0	33.4	0.0

2) Rubber

F/S area	Place of sales				Payment received				Buyers				Problem in Marketing										
	Farm (%)	Village market (%)	Amphoe market (%)	Changwat market (%)	Other (%)	Cash (%)	Credit (%)	Loan reduction (%)	Other (%)	Consumer (%)	Merchant (%)	Processor (%)	Coop (%)	Gov. (%)	Other (%)	Price fluctuation (%)	Price low (%)	Weight cheated (%)	No market (%)	No transportation (%)	No problem (%)	Other (%)	
																							Other (%)
Bacho	10.0	5.0	10.0	25.0	0.0	50.0	0.0	0.0	0.0	10.0	40.0	0.0	0.0	0.0	0.0	35.0	23.5	0.0	0.0	0.0	0.0	0.0	0.0
Kab Daebg	15.0	21.6	13.8	45.4	4.1	37.5	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	70.0	77.5	0.0	0.0	0.0	0.0	0.0	0.0
Muro Khoknai	0.0	0.0	14.3	42.9	0.0	57.1	0.0	0.0	0.0	0.0	57.1	0.0	0.0	0.0	0.0	38.0	42.9	0.0	0.0	0.0	0.0	0.0	0.0

3) Coconut

F/S area	Place of sales				Payment received				Buyers				Problem in Marketing										
	Farm (%)	Village market (%)	Amphoe market (%)	Changwat market (%)	Other (%)	Cash (%)	Credit (%)	Loan reduction (%)	Other (%)	Consumer (%)	Merchant (%)	Processor (%)	Coop (%)	Gov. (%)	Other (%)	Price fluctuation (%)	Price low (%)	Weight cheated (%)	No market (%)	No transportation (%)	No problem (%)	Other (%)	
																							Other (%)
Bacho	26.7	20.3	5.3	27.7	0.0	80.0	0.0	0.0	0.0	15.3	57.0	7.7	0.0	0.0	0.0	72.5	53.7	0.0	2.5	0.0	2.0	2.0	0.0
Kab Daebg	43.8	19.4	0.0	23.1	26.3	75.0	12.5	0.0	0.0	17.5	100.0	12.5	0.0	0.0	0.0	80.8	66.1	0.0	0.0	0.0	0.0	0.0	0.0
Muro Khoknai	30.4	47.9	4.4	15.4	1.9	100.0	0.0	0.0	0.0	12.0	100.0	0.0	0.0	0.0	0.0	90.4	48.7	0.0	0.0	0.0	2.4	2.4	0.0

4) Vegetable

F/S area	Payment received										Buyers					Problem in Marketing											
	Place of sales					Loan reduction					Cash (%)	Credit (%)	Other (%)	Consumer (%)	Merchant (%)	Processor (%)	Coop (%)	Gov. (%)	Other (%)	Price fluctuation (%)	Price low (%)	Weight cheated (%)	No market (%)	No transportation (%)	No problem (%)	Other (%)	
	Village market (%)	Amphoe market (%)	Changwat market (%)	Other (%)	Loan reduction (%)	Cash (%)	Credit (%)	Other (%)	Consumer (%)	Merchant (%)																	Processor (%)
Bacho	19.3	12.6	9.9	41.4	0	76.7	3.3	0.0	0.0	63.4	45.4	7.7	0.0	0.0	0.0	0.0	0.0	0.0	47.2	13.3	0.0	1.7	0.0	0.0	0.0	0.0	0.0
Kab Daebg	33.3	20.9	12.6	8.3	0.0	87.5	0.0	0.0	0.0	62.5	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	75.0	23.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Muro Khokrai	16.6	58.6	7.7	0.0	2.9	80.9	4.9	0.0	0.0	27.7	78.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	72.9	45.7	0.0	0.0	0.0	0.0	10.0	0.0	0.0

5) Livestock

F/S area	Payment received										Buyers					Problem in Marketing												
	Place of sales					Loan reduction					Cash (%)	Credit (%)	Other (%)	Consumer (%)	Merchant (%)	Processor (%)	Coop (%)	Gov. (%)	Other (%)	Price fluctuation (%)	Price low (%)	Weight cheated (%)	No market (%)	No transportation (%)	No problem (%)	Other (%)		
	Village market (%)	Amphoe market (%)	Changwat market (%)	Other (%)	Loan reduction (%)	Cash (%)	Credit (%)	Other (%)	Consumer (%)	Merchant (%)																	Processor (%)	Coop (%)
Eacho Kab	52.8	30.0	1.0	6.2	6.8	80.0	3.3	0.0	0.0	32.6	50.0	6.7	0.0	0.0	0.0	0.0	0.0	0.0	69.3	14.2	0.0	0.0	0.0	0.0	0.0	5.0	0.0	0.0
Daebg	58.4	39.5	0.0	0.0	0.0	100.0	0.0	0.0	0.0	22.9	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	83.5	7.5	0.0	0.0	0.0	0.0	0.0	16.5	0.0	0.0
Muro Khokrai	19.1	80.86	0.0	0.0	0.0	100.0	0.0	0.0	0.0	10.7	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	88.7	13.6	0.0	0.0	0.0	0.0	4.9	0.0	0.0	

6) Fish

F/S area	Payment received										Buyers					Problem in Marketing													
	Place of sales					Loan reduction					Cash (%)	Credit (%)	Other (%)	Consumer (%)	Merchant (%)	Processor (%)	Coop (%)	Gov. (%)	Other (%)	Price fluctuation (%)	Price low (%)	Weight cheated (%)	No market (%)	No transportation (%)	No problem (%)	Other (%)			
	Village market (%)	Amphoe market (%)	Changwat market (%)	Other (%)	Loan reduction (%)	Cash (%)	Credit (%)	Other (%)	Consumer (%)	Merchant (%)																	Processor (%)	Coop (%)	Gov. (%)
Bacho Kab	10.0	0.0	10.0	0.0	0.0	10.0	0.0	0.0	0.0	10.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7	1.7	0	0	0	0	0	0	0	0	0
Daebg																													
Muro Khokrai	0.0	14.3	0.0	0.0	0.0	14.0	0.0	0.0	0.0	14.3	14.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

7) Cashewnut

F/S area	Payment received										Buyers						Problem in Marketing											
	Place of sales						Credit				Consumer						Price fluctuation			Weight cheated			No trans-portion			Other		
	Farm (%)	Village market (%)	Amphoe market (%)	Changwat market (%)	Other (%)	Cash (%)	Credit (%)	Loan reduction (%)	Other (%)	Consumer (%)	Merchant (%)	Processor (%)	Coop (%)	Gov. (%)	Other (%)	Price fluctuation (%)	Price low (%)	Weight cheated (%)	No market (%)	No trans-portion (%)	No problem (%)	Other (%)						
Bacho	41.7	20.0	3.3	0.0	3.3	22.9	3.3	0.0	0.0	10.0	50.0	0.0	0.0	0.0	0.0	56.7	56.7	50.8	0.0	0	1.7	0.0						
Kab Daebg	0.0	31.3	0.0	6.3	0.0	37.5	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	37.5	37.5	12.5	0.0	0.0	0.0	0.0							
Muro Khoknai	28.6	0.0	0.0	0.0	0.0	29.0	0.0	0.0	0.0	28.6	14.0	0.0	0.0	0.0	28.6	14.3	14.3	0.0	0.0	0.0	0.0							

Table I-2-15 Off - Farm Income

F/S area	Farm labor			Non-Farm labor			Wood cutting, charcoal making			Rent
	Number of person no.	Income Baht/year	Working Place	Number of person no.	Income Baht/year	Working Place	Number of person no.	Income Baht/year	Working Place	
Bacho	0.70	5,612.40	1.91	0.81	18,917.20	2.02	0.07	716.00	0.40	0.00
Kab Daeng	0.54	4,911.88	0.00	1.14	20,966.13	0.00	0.03	229.13	0.00	20.75
Muno Koknai	0.07	1,100.00	0.00	0.79	16,969.14	0.00	0.00	0.00	0.00	90.71

F/S area	Profit from Business			Bounus, pension			Others			Total	
	Number of person no.	Income Baht/year	Working Place	Number of person no.	Income Baht/year	Working Place	Number of person no.	Income Baht/year	Working Place	Number of person no.	Income Baht/year
Bacho	0.11	3,121.80	1.40	0.01	177.70	0.40	0.35	4,762.10	1.60	0.00	33,307.20
Kab Daeng	0.06	1,275.00	0.00	0.03	500.00	0.00	0.28	8,056.63	0.00	0.00	35,959.50
Muno Koknai	0.07	2,176.14	0.00	0.03	7.14	0.00	0.19	1,847.71	0.00	0.00	22,192.29

Table I-2-16 Household Expense

F/S area	(Baht)											Total	
	Foods	Medical & Health care	Fuel & Energy	Education	Garment & clothes	Transport & Traveling	House Repair	Household goods	Liquor & cigarettes	Tax	Ceremony		Other
Bacho	14,297	1,156	666	3,021	1,967	1,799	2,544	2,134	1,451	129.59	1,263	499	30,925.29
Kab Daeng	12,962	991	510	3,293	1,603	1,506	1,550	3,078	1,126	151.00	1,126	1,143	29,071.00
Muno koknai	9,132	1,130	645	3,023	1,806	1,690	6,143	2,209	1,735	176.57	1,735	448	29,322.00

Table I-2-17 Household Income and Expenditure

F/S area	Crops			Livestock			Off-farm			Household			Total	
	Income (Baht)	Expenditure (Baht)	Income (Baht)	Expenditure (Baht)	Income (Baht)	Expenditure (Baht)	Income (Baht)	Expenditure (Baht)	Income (Baht)	Expenditure (Baht)	Income (Baht)	Expenditure (Baht)	Income (Baht)	Expenditure (Baht)
Bacho	8,240.30	2,044.60	4,685.00	177.30	33,307.20	0.00	0.00	30,925.29	46,232.50	33,147.19				
Kab Daeng	11,023.50	3,979.63	4,774.75	73.50	35,959.50	0.00	0.00	29,071.00	51,757.75	33,124.13				
Muno Khknai	7,922.00	3,950.29	9,438.29	847.29	22,192.29	0.00	0.00	29,750.57	39,552.57	34,548.14				

Table I-2-18 Social Condition

F/S area	Source of drinking water					Electricity					Source of energy					Find natural burning				Burn forest by yourself			
	Piped (%)	Deep well (%)	Shallow (%)	River (%)	Spring (%)	Other (%)	Yes (%)	No (%)	Wood (%)	Gas (%)	Petroleum (%)	Charcoal (%)	Other (%)	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)		
Bacho	0.0	4.2	95.8	0.0	0.0	1.7	93.3	6.7	37.4	31.0	1.7	46.1	1.7	91.6	8.4	38.4	61.6						
Kab Daeng	0.0	8.3	93.8	0.0	0.0	0.0	93.6	6.4	41.8	31.3	0.0	54.3	2.1	64.5	35.5	37.4	62.6						
Muno koknai	0.0	4.2	97.6	0.0	0.0	9.6	100.0	0.0	42.9	73.7	0.0	23.9	2.4	50.0	50.0	7.1	92.9						

Table I-2-19 Agriculture Supporting Service (1/4)

F/S area	Location	Cooperative										
		BAAC					Water user's association					
		(You) Member (%)	(You family) Member (%)	Farm Input (%)	Marking (%)	Credit (%)	Location	(You) Member (%)	(You family) Member (%)	Farm Input (%)	Marking (%)	Credit (%)
Bacho	2	27.3	1.7	1.7	3.4	26.7	1,2,4	46.7	3.3	11.7	8.6	24.9
Kab Daeng	2,3	31.3	2.1	6.3	12.5	33.3	2,3	16.8	2.1	18.9	14.6	18.9
Muno koknai	3	19.1	2.4	12.7	7.1	21.6	3,4	23.9	4.9	9.6	14.4	14.3

Note : Location 1. Bacho, 2. Muang, 3. Takbai, 4. Village

Agriculture Supporting Service (2/4)

F/S area	Location	Farmer's Association										
		Farmer's Association					Water user's association					
		(You) Member (%)	(You family) Member (%)	Farm Input (%)	Marking (%)	Credit (%)	Location	(You) Member (%)	(You family) Member (%)	Farm Input (%)	Marking (%)	Credit (%)
Bacho	4	3.3	1.7	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kab Daeng	4	4.1	0.0	2.1	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
Muno koknai	4	16.7	0.0	16.7	2.4	16.7	-	0.0	0.0	0.0	0.0	0.0

Note : Location 1. Bacho, 2. Muang, 3. Takbai, 4. Village

Agriculture Supporting Service (3/4)

F/S area	Women Group Association										
	Rice Bank Group					Other					
	Location	(You) Member (%)	(You family) Member (%)	What kinds of advantage			Location	(You) Member (%)	(You family) Member (%)	What kinds of advantage	
			Farm Input (%)	Marking (%)	Credit (%)				Farm Input (%)	Marking (%)	Credit (%)
Bacho	-	0.0	0.0	0.0	0.0	1.4	1.7	11.8	11.5	8.5	0.0
Kab Daeng	-	0.0	0.0	0.0	0.0	4	0.0	4.3	4.3	4.3	0.0
Muno koknai	-	0.0	0.0	0.0	0.0	4	9.4	4.7	9.6	4.9	2.4

Note : Location 1. Bacho, 2. Muang, 3. Takbai, 4. Village

Agriculture Supporting Service (4/4)

F/S area	Other										
	Saving Group					Other					
	Location	(You) Member (%)	(You family) Member (%)	What kinds of advantage			Location	(You) Member (%)	(You family) Member (%)	What kinds of advantage	
			Farm Input (%)	Marking (%)	Credit (%)				Farm Input (%)	Marking (%)	Credit (%)
Bacho	4	8.3	3.3	0.0	6.7	-	0.0	0.0	0.0	0.0	0.0
Kab Daeng	4	2.1	2.1	2.1	2.1	-	0.0	0.0	0.0	0.0	0.0
Muno koknai	4	14.3	14.3	0.0	14.3	-	2.4	4.7	7.1	4.7	0.0

Note : Location 1. Bacho, 2. Muang, 3. Takbai, 4. Village

Table I-2-20 Present Problem

F/S area	No health Service (%)	Poor Communication (%)	No Electricity (%)	Drinking water (%)	Irrigation water (%)	Flood (%)	Lack of capital (%)	Other (%)
Bacho	16.0	23.0	6.7	15.6	46.0	45.9	89.2	3.3
Kab Daeng	16.6	6.3	6.4	31.1	60.4	25.1	75.0	0.0
Muno koknai	33.4	14.3	0.0	19.0	54.9	38.3	69.0	0.0

Table I-2-21 Requirement

F/S area	Road				Irrigation cannal				Drainage cannal			
	1	2	3	4	1	2	3	4	1	2	3	4
Bacho	10.7	5.0	5.1	3.4	27.4	7.0	6.4	5.1	6.4	9.1	7.5	5.8
Kab Daeng	0.0	0.0	0.0	0.0	14.6	16.6	22.9	8.4	0.0	4.3	4.3	14.6
Muno koknai	2.4	0.0	0.0	7.3	31.0	19.1	12.0	2.4	2.4	2.4	12.0	2.4

F/S area	School				Health center				Extention			
	1	2	3	4	1	2	3	4	1	2	3	4
Bacho	1.7	0.0	0.7	0.7	4.9	3.4	4.8	3.1	21.3	30.2	9.8	9.7
Kab Daeng	0.0	0.0	0.0	0.0	8.4	10.4	2.1	4.1	27.1	27.1	14.6	8.4
Muno koknai	0.0	0.0	0.0	4.9	4.9	4.9	4.7	12.0	16.6	33.3	16.7	4.9

F/S area	Credit service				Cooperative				Comunication			
	1	2	3	4	1	2	3	4	1	2	3	4
Bacho	16.2	13.2	15.0	5.8	0.0	5.0	2.3	3.4	1.7	1.7	3.0	1.7
Kab Daeng	18.8	14.6	2.1	6.3	4.3	6.3	16.8	6.3	0.0	0.0	0.0	0.0
Muno koknai	14.1	4.9	7.3	7.3	0.0	4.9	4.9	2.4	2.4	2.4	7.1	2.4

F/S area	Drinking water				Irrigation water			
	1	2	3	4	1	2	3	4
Bacho	0.0	5.1	5.1	4.1	8.3	16.3	19.4	7.9
Kab Daeng	10.5	2.1	2.1	10.5	6.3	12.6	16.8	8.4
Muno koknai	7.3	0.0	4.9	7.1	12.1	21.3	21.4	9.6

Table I-2-22 Farm Practice

F/S area	Have farm Machinery (Power tiller)		Land Preparation by hired people				Lime application 1/	
	Yes (%)	No (%)	Yes (%)	No (%)	Animal (Baht)	Labor (Baht)	Yes (%)	No (%)
Bacho	25.6	68.9	30.5	59.5	37.1	202.2	16.4	3.6
Kab Daeng	45.8	54.3	27.3	72.8	28.3	214.6	-	-
Muno koknai	85.7	14.3	12.0	88.0	0.0	317.0	-	-

Table I-3-1 Financial and Economic project Cost of 3 F/S Areas

(Unit:1,000Baht)

Description	Bacho F/S Area		Kab Daeng F/S Area		Muno-Koknai F/S Area	
	Cost		Cost		Cost	
	Financial	Economic	Financial	Economic	Financial	Economic
1. Construction Cost						
1-1 Land Reclamation	9,244	8,649	17,954	16,804	20,540	19,445
1-2 Agricultural Infrastructure	36,865	33,445	36,669	33,374	59,844	54,204
1-3 Agricultural Supporting Facilit	8,440	8,440	5,770	5,770	9,010	9,010
Sub Total	54,549	50,535	60,393	55,947	89,394	82,659
2. Project Administration	3,572	3,270	2,393	2,200	3,580	3,275
3. Consulting Services						
3-1 Detailed Design	2,995	2,995	3,030	3,030	4,394	4,394
3-2 Supervision	4,494	4,494	4,542	4,542	5,364	5,364
Sub Total	7,489	7,489	7,572	7,572	9,758	9,758
4. Agricultural Supporting Service	16,773	16,695	12,931	12,896	16,844	16,758
Total (1-4)	82,383	77,988	83,289	78,615	119,576	112,449
5. Physical Contingency (1-4)x10%	8,238	7,799	8,329	7,862	11,958	11,245
Total (1-5)	90,621	85,787	91,618	86,477	131,534	123,694

Table I-3-2 Financial and Economic Project Cost of 3 Development Types for the Narathiwat Province

Description	(Unit: 1,000Baht)					
	Bacho Type		Kab Daeng Type		Muno-Koknai Type	
	Financial	Economic	Financial	Economic	Financial	Economic
1. Construction Cost						
1-1 Land Reclamation	107,113	100,220	75,386	70,555	41,331	39,126
1-2 Agricultural Infrastructure	427,198	387,571	153,979	140,142	120,406	109,059
1-3 Agricultural Supporting Facilit.	0	0	0	0	0	0
Sub Total	534,311	487,790	229,365	210,697	161,737	148,186
2. Project Administration	26,716	24,390	11,468	10,535	8,087	7,409
3. Consulting Services						
3-1 Detailed Design	22,443	22,443	9,633	9,633	6,792	6,792
3-2 Supervision	33,660	33,660	14,450	14,450	10,190	10,190
Sub Total	56,103	56,103	24,083	24,083	16,982	16,982
4. Agricultural Supporting Service	0	0	0	0	0	0
Total (1-4)	617,130	568,283	264,916	245,315	186,806	172,577
5. Physical Contingency (1-4)x10%	61,713	56,828	26,492	24,531	18,681	17,258
Total (1-5)	678,843	625,112	291,408	269,846	205,487	189,835

Table I-3-3 Economic Cost Stream in Bacho F/S Area

Unit : 1,000 Baht

Description	1st Year			2nd Year			3rd Year			4th Year			5th Year			6th Year			Total					
	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total			
1. Construction Cost																								
1-1 Land Reclamation	0	0	0	1,286	1,309	2,595	2,144	2,182	4,326	857	872	1,729	0	0	0	0	0	0	0	0	0	4,287	4,362	8,649
1-2 Agricultural Infrastructure	0	0	0	2,510	7,523	10,033	4,184	12,539	16,723	1,674	5,015	6,689	0	0	0	0	0	0	0	0	0	8,368	25,077	33,445
1-3 Agricultural Supporting Facility	0	0	0	8,440	0	8,440	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8,440	0	8,440
Sub Total	0	0	0	12,236	8,832	21,068	6,328	14,721	21,049	2,531	5,887	8,418	0	0	0	0	0	0	0	0	0	21,095	29,440	50,535
2. Project Administration	936	554	1,490	39	554	593	39	554	593	38	554	592	0	0	0	0	0	0	0	0	0	1,052	2,218	3,270
3. Consulting Services																								
3-1 Detailed Design	2,995	0	2,995	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,995	0	2,995
3-2 Supervision	0	0	0	1,498	0	1,498	1,498	0	1,498	1,498	0	1,498	0	0	0	0	0	0	0	0	0	4,494	0	4,494
Sub Total	2,995	0	2,995	1,498	0	1,498	1,498	0	1,498	1,498	0	1,498	0	0	0	0	0	0	0	0	0	7,489	0	7,489
4. Agricultural Supporting Service	0	0	0	0	0	0	4,031	143	4,174	4,031	143	4,174	4,031	143	4,174	4,032	143	4,175	4,032	143	4,175	16,125	570	16,695
Total (1-4)	3,931	554	4,485	13,773	9,386	23,159	11,896	15,418	27,314	8,098	6,584	14,682	4,031	143	4,174	4,032	143	4,175	4,032	143	4,175	45,761	32,227	77,988
5. Physical Contingency (1-4)x10%	393	55	449	1,377	939	2,316	1,190	1,542	2,731	810	658	1,468	403	14	417	403	14	417	403	14	417	4,576	3,223	7,799
Total (1-5)	4,324	610	4,934	15,150	10,325	25,475	13,086	16,959	30,045	8,908	7,243	16,150	4,434	157	4,591	4,435	157	4,592	4,435	157	4,592	50,337	35,450	85,787

Table I-3-4 Economic Cost Stream in Kab daeng F/S Area

Unit : 1,000 Baht

Description	1st Year			2nd Year			3rd Year			4th Year			5th Year			6th Year			Total				
	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total		
1. Construction Cost																							
1-1 Land Reclamation	0	0	0	3,347	3,375	6,722	5,020	5,062	10,082	0	0	0	0	0	0	0	0	0	8,367	8,437	16,804		
1-2 Agricultural Infrastructure	0	0	0	3,683	9,666	13,349	5,525	14,500	20,025	0	0	0	0	0	0	0	0	0	9,208	24,166	33,374		
1-3 Agricultural Supporting Facility	0	0	0	5,770	0	5,770	0	0	0	0	0	0	0	0	0	0	0	0	5,770	0	5,770		
Sub Total	0	0	0	12,800	13,041	25,841	10,545	19,562	30,107	0	0	0	0	0	0	0	0	0	23,345	32,602	55,947		
2. Project Administration	709	473	1,182	38	0	38	37	472	509	0	0	0	0	0	0	0	0	0	784	944	1,728		
3. Consulting Services																							
3-1 Detailed Design	3,030	0	3,030	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,030	0	3,030		
3-2 Supervision	0	0	0	1,514	0	1,514	1,514	0	1,514	1,514	0	1,514	1,514	0	1,514	0	0	0	4,542	0	4,542		
Sub Total	3,030	0	3,030	1,514	0	1,514	1,514	0	1,514	1,514	0	1,514	1,514	0	1,514	0	0	0	7,572	0	7,572		
4. Agricultural Supporting Service	0	0	0	0	0	0	4,213	85	4,298	4,213	85	4,298	4,213	86	4,299	4,213	86	4,299	12,639	257	12,896		
Total (1-4)	3,739	473	4,212	14,352	13,041	27,393	16,309	20,119	36,428	5,727	85	5,812	4,213	86	4,299	4,213	86	4,299	44,340	33,803	78,143		
5. Physical Contingency (1-4)x10%	374	47	421	1,435	1,304	2,739	1,631	2,012	3,643	573	9	581	421	9	430	421	9	430	4,434	3,380	7,814		
Total (1-5)	4,113	520	4,633	15,787	14,345	30,132	17,940	22,130	40,070	6,300	94	6,394	4,634	95	4,729	4,634	95	4,729	48,774	37,184	85,958		

Table I-3-5 Economic Cost Stream in Muno-Koknai F/S Area

Unit : 1,000 Baht

Description	1st Year			2nd Year			3rd Year			4th Year			5th Year			6th Year			Total			
	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total	
1. Construction Cost																						
1-1 Land Reclamation	0	0	0	3,423	2,410	5,833	5,706	4,016	9,722	2,282	1,607	3,889	0	0	0	0	0	0	11,411	8,034	19,445	
1-2 Agricultural Infrastructure	0	0	0	3,854	12,407	16,261	6,424	20,678	27,102	2,570	8,271	10,841	0	0	0	0	0	0	12,848	41,356	54,204	
1-3 Agricultural Supporting Facility	0	0	0	9,010	0	9,010	0	0	0	0	0	0	0	0	0	0	0	0	9,010	0	9,010	
Sub Total	0	0	0	16,287	14,817	31,104	12,130	24,695	36,825	4,852	9,878	14,730	0	0	0	0	0	0	33,269	49,390	82,659	
2. Project Administration	920	560	1,480	39	560	599	39	560	599	38	554	592	0	0	0	0	0	0	1,036	2,233	3,269	
3. Consulting Services																						
3-1 Detailed Design	4,394	0	4,394	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,394	0	4,394	
3-2 Supervision	0	0	0	2,196	0	2,196	2,196	0	2,196	2,196	0	2,196	0	0	0	0	0	0	6,588	0	6,588	
Sub Total	4,394	0	4,394	2,196	0	2,196	2,196	0	2,196	2,196	0	2,196	0	0	0	0	0	0	10,982	0	10,982	
4. Agricultural Supporting Service	0	0	0	0	0	0	4,031	158	4,189	4,031	158	4,189	4,031	158	4,189	4,031	158	4,189	16,124	634	16,758	
Total (1-4)	5,314	560	5,874	18,522	15,377	33,899	18,396	25,413	43,809	11,117	10,591	21,708	4,031	158	4,189	4,031	158	4,189	61,411	52,257	113,668	
5. Physical Contingency (1-4)x10%	531	56	587	1,852	1,538	3,390	1,840	2,541	4,381	1,112	1,059	2,171	403	16	419	403	16	419	6,141	5,226	11,367	
Total (1-5)	5,845	616	6,461	20,374	16,915	37,289	20,236	27,954	48,190	12,229	11,650	23,879	4,434	174	4,608	4,434	174	4,608	67,552	57,483	125,035	

Table I-3-6 Economic Cost Stream in Bacho Development Type

Unit : 1,000 Baht

Description	1st Year			2nd Year			3rd Year			4th Year			5th Year			6th Year			Total					
	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total			
1. Construction Cost																								
1-1 Land Reclamation	0	0	0	4,967	5,056	10,023	14,899	15,165	30,064	9,934	10,110	20,044	9,934	10,110	20,044	9,934	10,110	20,044	9,934	10,110	20,044	49,668	50,552	100,220
1-2 Agricultural Infrastructure	0	0	0	9,697	29,060	38,757	29,092	87,181	116,273	19,394	58,120	77,514	19,394	58,120	77,514	19,394	58,120	77,514	19,394	58,120	77,514	96,971	290,600	387,571
1-3 Agricultural Supporting Facility	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sub Total	0	0	0	14,664	34,116	48,780	43,991	102,346	146,337	29,328	68,230	97,558	29,328	68,230	97,558	29,328	68,230	97,558	29,328	68,230	97,558	146,639	341,151	487,790
2. Project Administration	1,466	3,411	4,877	1,100	2,559	3,659	1,100	2,559	3,659	1,320	3,070	4,390	1,246	2,900	4,146	1,246	2,900	4,146	1,100	2,559	3,659	7,332	17,058	24,390
3. Consulting Services																								
3-1 Detailed Design	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3-2 Supervision	0	0	0	6,732	0	6,732	6,732	0	6,732	6,732	0	6,732	6,732	0	6,732	6,732	0	6,732	6,732	0	6,732	33,660	0	33,660
Sub Total	0	0	0	6,732	0	6,732	6,732	0	6,732	6,732	0	6,732	6,732	0	6,732	6,732	0	6,732	6,732	0	6,732	33,660	0	33,660
4. Agricultural Supporting Service	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total (1-4)	1,466	3,411	4,877	22,496	36,675	59,171	51,823	104,905	156,728	37,380	71,300	108,680	37,306	71,130	108,436	37,160	70,789	107,949	37,160	70,789	107,949	187,631	358,209	545,840
5. Physical Contingency (1-4)x10%	147	341	488	2,250	3,667	5,917	5,182	10,490	15,673	3,738	7,130	10,868	3,731	7,113	10,844	3,716	7,079	10,795	3,716	7,079	10,795	18,763	35,821	54,584
Total (1-5)	1,613	3,752	5,365	24,746	40,342	65,088	57,005	115,395	172,401	41,118	78,430	119,548	41,037	78,242	119,279	40,876	77,868	118,744	40,876	77,868	118,744	206,394	394,030	600,424

Table I-3-7 Economic Cost Stream in Kab Daeng Development Type

Unit : 1,000 Baht

Description	1st Year			2nd Year			3rd Year			4th Year			5th Year			6th Year			Total					
	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total			
1. Construction Cost																								
1-1 Land Reclamation	0	0	0	3,513	3,543	7,056	10,539	10,628	21,167	7,025	7,086	14,111	7,025	7,086	14,111	7,025	7,086	14,111	35,127	35,428	70,555			
1-2 Agricultural Infrastructure	0	0	0	3,867	10,147	14,014	11,603	30,442	42,045	7,734	20,294	28,028	7,734	20,294	28,028	7,734	20,294	28,028	38,572	101,470	140,142			
1-3 Agricultural Supporting Facility	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
Sub Total	0	0	0	7,380	13,690	21,070	22,142	41,070	63,212	14,759	27,379	42,138	14,759	27,379	42,138	14,759	27,379	42,138	73,799	136,898	210,697			
2. Project Administration	737	1,368	2,105	554	1,027	1,581	554	1,027	1,581	664	1,232	1,896	627	1,163	1,790	554	1,027	1,581	3,690	6,845	10,535			
3. Consulting Services																								
3-1 Detailed Design	9,633	0	9,633	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9,633	0	9,633			
3-2 Supervision	0	0	0	2,890	0	2,890	2,890	0	2,890	2,890	0	2,890	2,890	0	2,890	2,890	0	2,890	11,560	0	11,560			
Sub Total	9,633	0	9,633	2,890	0	2,890	2,890	0	2,890	2,890	0	2,890	2,890	0	2,890	2,890	0	2,890	21,193	0	21,193			
4. Agricultural Supporting Service	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
Total (1-4)	10,370	1,368	11,738	10,824	14,717	25,541	25,586	42,097	67,683	18,313	28,611	46,924	18,276	28,543	46,819	18,203	28,406	46,609	101,572	143,743	242,425			
5. Physical Contingency (1-4)x10%	1,037	137	1,174	1,082	1,472	2,554	2,559	4,210	6,768	1,831	2,861	4,692	1,828	2,854	4,682	1,820	2,841	4,661	10,157	14,374	24,531			
Total (1-5)	11,407	1,505	12,912	11,906	16,189	28,095	28,145	46,306	74,451	20,144	31,473	51,617	20,104	31,397	51,501	20,023	31,247	51,270	111,729	158,117	269,846			

Table I-3-8 Economic Cost Stream for Muno-Koknai Development Type

Unit : 1,000 Baht

Description	1st Year			2nd Year			3rd Year			4th Year			5th Year			6th Year			Total					
	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total			
1. Construction Cost																								
1-1 Land Reclamation	0	0	0	2,296	1,617	3,913	6,888	4,851	11,739	4,592	3,233	7,825	4,592	3,233	7,825	4,592	3,233	7,825	22,960	16,166	39,126			
1-2 Agricultural Infrastructure	0	0	0	2,585	8,321	10,906	7,755	24,963	32,718	5,170	16,642	21,812	5,170	16,642	21,812	5,170	16,642	21,812	25,850	83,209	109,059			
1-3 Agricultural Supporting Facility	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
Sub Total	0	0	0	4,881	9,938	14,819	14,643	29,814	44,457	9,762	19,875	29,637	9,762	19,875	29,637	9,762	19,875	29,637	48,810	99,376	148,186			
2. Project Administration	489	994	1,483	366	745	1,111	366	745	1,111	439	894	1,333	415	845	1,260	366	745	1,111	2,441	4,988	7,409			
3. Consulting Services																								
3-1 Detailed Design	6,792	0	6,792	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6,792	0	6,792			
3-2 Supervision	0	0	0	2,038	0	2,038	2,038	0	2,038	2,038	0	2,038	2,038	0	2,038	2,038	0	2,038	10,190	0	10,190			
Sub Total	6,792	0	6,792	2,038	0	2,038	2,038	0	2,038	2,038	0	2,038	2,038	0	2,038	2,038	0	2,038	16,982	0	16,982			
4. Agricultural Supporting Service	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
Total (1-4)	7,281	994	8,275	7,285	10,683	17,968	17,047	30,559	47,606	12,239	20,769	33,008	12,215	20,720	32,935	12,166	20,620	32,786	68,233	104,344	172,577			
5. Physical Contingency (1-4)x10%	728	99	827	729	1,068	1,797	1,705	3,056	4,761	1,224	2,077	3,301	1,222	2,072	3,293	1,217	2,062	3,279	6,823	10,434	17,258			
Total (1-5)	8,009	1,093	9,102	8,014	11,752	19,765	18,752	33,615	52,366	13,463	22,846	36,309	13,437	22,792	36,228	13,383	22,682	36,065	75,056	114,779	189,835			

Table I-3-9 Annual O & M Cost of 3 F/S Areas

(1,000Baht)		
Areas	Financial	Economic...1/
Bacho	393	346
Kab Daeng	323	284
Muno-Koknai	393	345
Total	1,108	975

Note; 1/0.88 of conversion factor is applied .

Table I-3-10 Annual O & M Cost of 3 Development Types

(1,000Baht)		
Types	Financial	Economic...1/
Bacho	4,516	3,974
Kab Daeng	1,355	1,192
Muno-Koknai	785	691
Total	6,656	5,857

Note; 1/0.88 of conversion factor is applied .

Table I-3-11 Summary of Agricultural Commodity Prices

Commodities	Unit	Financial	Economic
1.Out put			
	Baht/kg		
1) Paddy Local		3.7	4.3
2) Paddy HYV		3.9	4.5
3) Baby Corn		12.0	12.0
4) Yard Longbean		7.0	7.0
5) Chili		30.0	30.0
6) Coconut(aromatic)	Baht/plant	5.0	5.0
7) Pinapple	Baht/plant	1.0	1.0
8) Fish		30	30
2.Input			
1) Paddy Local	Baht/kg	3.7	4.3
2) Paddy HYV		3.9	4.5
3) Baby Corn		70	64
4) Yard Longbean		40	37
5) Chili		1,000	920
6) Coconut(aromatic)	Baht/plant	8.0	7.4
7) Pinapple	Baht/10plants	0.5	0.5
8) Fish	Baht/10flies	50	46
9) Urea	Baht/kg	6.1	5.7
10) TSP		5.4	5.0
11) MP		5.0	4.6
12) 13-13-21		5.1	4.6
13) 15-15-15		5.2	4.7
14) Lime dust		0.3	0.28
15) Agro-chemical		100	92
16) Labor	Baht/day	80	74

Table I-3-12 Price Structure of Agricultural Commodities

- Rice -

Description	Unit	Financial Price	Conversion Factor	Economic Price
1) Projected world market price at 1985 constant price US \$/Ton 5% broken white rice, FOB Bangkok...a/		192		192
2) Multiplier to 1992 constant price (x 1.5291)...b/	US \$/Ton	294		294
3) Baht equivalent...c/	B/Ton	7,340		7,340
4) Adjustment for quality...d/	%	97		97
5) Weighted average export price	B/Ton	7,119		7,119
6) Port charge	B/Ton	200	0.70	140
7) Export duty...c/	B/Ton	178		-
8) Taxes(Business and municipal taxes)...f/	B/Ton	7		-
9) Exporter's margin...g/	B/Ton	285	0.70	199
10) Wholesaler's margin...h/	B/Ton	178	0.70	125
11) Transport and handling charge ...i/	B/Ton	495	0.87	431
12) Ex-mill price of rice	B/Ton	5,777		6,225
13) Ex-mill price of paddy...j/	B/Ton	4,275		4,606
14) Milling tax...k/	B/Ton	107		-
15) Miller's margin...l/	B/Ton	299	0.70	209
15) Input price of paddy at mill	B/Ton	3,869		4,397
16) Merchant's margin...m/	B/Ton	174	0.70	122
17) Farmgate price of paddy	B/Ton	3,695		4,275

Note;

a) From World Bank Commodity Price Forecasts of Aug. 1992.

b) World Bank international inflation indices.

c) US \$= 25.0 Bath.

d) The average export price adjusted for quality is assumed to be 97 percent of f.o.b. price of broken rice.

e) 2.5 percent of weighted average export price.

f) 0.1 percent of weighted average export price.

g) 4 percent of weighted average export price.

h) 2.5 percent of weighted average export price.

i) Based on 345 Baht per ton from Bangkok to Narathiwat by 10 tons container and plus 150 Baht for handling charge and local transportation from railway station to project site.

j) Milling ratio of 66 percent plus the value of by-product, for which 8 percent has been added to milling ratio.

k) 2.5 percent of ex-mill price of paddy.

l) 7 percent of ex-mill price of paddy before tax.

m) 4.5 percent of input price of paddy at mill.

Table I-3-13 Price Structure of Agricultural Commodities
 - Urea, 46 percent N -

Description	Unit	Financial Price	Conversion Factor	Economic Price
1) Projected world market price at 1985 constant price US \$/Ton any origin, Bagged, F.O.B. N.W. Europe...a/		98		98
2) Multiplier to 1992 constant price (x 1.5291)...b/	US \$/Ton	150		150
3) Ocean freight and insurance	US \$/Ton	35		35
4) Import price, C.I.F. Bangkok	US \$/Ton	185		185
5) Import Tax...c/	US \$/Ton	6		-
6) Baht equivalent...d/	B/Ton	4,760		4,625
7) Port charge	B/Ton	30	0.70	21
8) Importer's/wholesaler's margin...e/	B/Ton	380	0.70	266
9) Transport Bangkok to project site...f/	B/Ton	495	0.87	431
10) Wholesaler's price	B/Ton	5,665		5,343
10) Retailer's margin...g/	B/Ton	453	0.70	317
11) Farmgate price.	B/Ton	6,118		5,660

Note;

a) From World Bank Commodity Price Forecasts of Aug. 1992.

b) World Bank international inflation indices.

c) 3 percent of import price.

d) US \$= 25.0 Baht.

e) 8 percent of import price.

f) Based on 345 Baht per ton from Bangkok to Narathiwat by 10 tons container and plus 150 Baht for handling charge and local transportation from railway station to project site.

g) 8 percent of wholesale's price including cost from retailer to farmgate.

Table I-3-14 Price Structure of Agricultural Commodities
 - Potassium Chloride, 60 percent of K₂O -

Description	Unit	Financial Price	Conversion Factor	Economic Price
1) Projected world market price at 1985 constant price US \$/Ton any origin, Bagged, F.O.B. N.W. Europe...a/		73		73
2) Multiplier to 1992 constant price (x 1.5291)...b/	US \$/Ton	112		112
3) Ocean freight and insurance	US \$/Ton	35		35
4) Import price, C.I.F. Bangkok	US \$/Ton	147		147
5) Import Tax...c/	US \$/Ton	4		-
6) Baht equivalent...d/	B/Ton	3,776		3,666
7) Port charge	B/Ton	30	0.70	21
8) Importer's/wholesaler's margin...e/	B/Ton	301	0.70	211
9) Transport Bangkok to project site...f/	B/Ton	495	0.87	431
10) Wholesaler's price	B/Ton	4,602		4,328
10) Retailer's margin...g/	B/Ton	368	0.70	258
11) Farmgate price.	B/Ton	4,970		4,586

Note;

a) From World Bank Commodity Price Forecasts of Aug. 1992.

b) World Bank international inflation indices.

c) 3 percent of import price.

d) US \$= 25.0 Baht.

e) 8 percent of import price.

f) Based on 345 Baht per ton from Bangkok to Narathiwat by 10 tons container and plus 150 Baht for handling charge and local transportation from railway station to project site.

g) 8 percent of wholesale's price including cost from retailer to farmgate.

Table I-3-15 Price Structure of Agricultural Commodities
 - Triple Super Phosphate, 45 percent of P2O5 -

Description	Unit	Financial Price	Conversion Factor	Economic Price
1) Projected world market price at 1985 constant price US \$/Ton any origin, Bagged, F.O.B. N.W. Europe...a/		82		82
2) Multiplier to 1992 constant price (x 1.5291)...b/	US \$/Ton	125		125
3) Ocean freight and insurance	US \$/Ton	35		35
4) Import price, C.I.F. Bangkok	US \$/Ton	160		160
5) Import Tax...c/	US \$/Ton	5		
6) Baht equivalent...d/	B/Ton	4,130		4,010
7) Port charge	B/Ton	30	0.70	21
8) Importer's/wholesaler's margin...e/	B/Ton	330	0.70	231
9) Transport Bangkok to project site...f/	B/Ton	495	0.87	431
10) Wholesaler's price	B/Ton	4,985		4,692
10) Retailer's margin...g/	B/Ton	399	0.70	279
11) Farmgate price.	B/Ton	5,383		4,971

Note;

a) From World Bank Commodity Price Forecasts of Aug. 1992.

b) World Bank international inflation indices.

c) 3 percent of import price.

d) US \$= 25.0 Baht.

e) 8 percent of import price.

f) Based on 345 Baht per ton from Bangkok to Narathiwat by 10 tons container and plus 150 Baht for handling charge and local transportation from railway station to project site.

g) 8 percent of wholesale's price including cost from retailer to farmgate.

Table I-3-16 Incremental Benefit of Bacho Area

Area: Bacho Crops	Project Year											
	3	4	5	6	7	8	9	10	11	12		
A. With project												
1 Paddy(wet)												
Benefit	308	308	308	308	308	308	308	308	308	308	308	308
Area	754	754	754	754	754	754	754	754	754	754	754	754
%	100	100	100	100	100	100	100	100	100	100	100	100
Benefit	232,232	232,232	232,232	232,232	232,232	232,232	232,232	232,232	232,232	232,232	232,232	232,232
2 Baby Corn												
Benefit	6,074	6,074	6,074	6,074	6,074	6,074	6,074	6,074	6,074	6,074	6,074	6,074
Area	107	107	107	107	107	107	107	107	107	107	107	107
%	200	200	200	200	200	200	200	200	200	200	200	200
Benefit	1,299,836	1,299,836	1,299,836	1,299,836	1,299,836	1,299,836	1,299,836	1,299,836	1,299,836	1,299,836	1,299,836	1,299,836
3 Longbean												
Benefit	1,314	1,314	1,314	1,314	1,314	1,314	1,314	1,314	1,314	1,314	1,314	1,314
Area	107	107	107	107	107	107	107	107	107	107	107	107
%	200	200	200	200	200	200	200	200	200	200	200	200
Benefit	281,196	281,196	281,196	281,196	281,196	281,196	281,196	281,196	281,196	281,196	281,196	281,196
4 Chilli												
Benefit	3,921	3,921	3,921	3,921	3,921	3,921	3,921	3,921	3,921	3,921	3,921	3,921
Area	107	107	107	107	107	107	107	107	107	107	107	107
%	200	200	200	200	200	200	200	200	200	200	200	200
Benefit	839,094	839,094	839,094	839,094	839,094	839,094	839,094	839,094	839,094	839,094	839,094	839,094
5 Pineapple												
Benefit	-229	2,603	2,603	2,603	2,603	2,603	2,603	2,603	2,603	2,603	2,603	2,603
Area	408	408	408	408	408	408	408	408	408	408	408	408
%	100	100	100	100	100	100	100	100	100	100	100	100
Benefit	-93,432	1,062,024	1,062,024	1,062,024	1,062,024	1,062,024	1,062,024	1,062,024	1,062,024	1,062,024	1,062,024	1,062,024
6 Forage												
Benefit	78	78	78	78	78	78	78	78	78	78	78	78
Area	88	88	88	88	88	88	88	88	88	88	88	88
%	100	100	100	100	100	100	100	100	100	100	100	100
Benefit	6,864	6,864	6,864	6,864	6,864	6,864	6,864	6,864	6,864	6,864	6,864	6,864
7 Fish												
Benefit	10,360	10,360	10,360	10,360	10,360	10,360	10,360	10,360	10,360	10,360	10,360	10,360
Area	14	14	14	14	14	14	14	14	14	14	14	14
%	300	300	300	300	300	300	300	300	300	300	300	300
Benefit	435,120	435,120	435,120	435,120	435,120	435,120	435,120	435,120	435,120	435,120	435,120	435,120
Total With Benefit(1000Bahr)	3,001	4,156	4,156	4,156	4,156	4,156	4,156	4,156	4,156	4,156	4,156	4,156
B. Without project												
1 Total Without Benefit	0	0	0	0	0	0	0	0	0	0	0	0
Incremental Benfir(1000Bahr) A-B	3,001	4,156	4,156	4,156	4,156	4,156	4,156	4,156	4,156	4,156	4,156	4,156

Table I-3-17 Incremental Benefit of Kab Daeng Area

Area: Kab-daeng	Project Year											
	3	4	5	6	7	8	9	10	11	12		
Crops	Unit											
A. With Project												
1 Paddy(wet)												
Benefit	308	308	308	308	308	736	736	736	736	736	736	736
Area	2,031	2,031	2,031	2,031	2,031	2,031	2,031	2,031	2,031	2,031	2,031	2,031
%	100	100	100	100	100	100	100	100	100	100	100	100
Incremental benefit	625,548	625,548	625,548	625,548	1,494,816	1,494,816	1,494,816	1,494,816	1,494,816	1,494,816	1,494,816	1,494,816
2 Paddy(dry)												
Benefit	510	510	510	510	814	814	814	814	814	814	814	814
Area	563	563	563	563	563	563	563	563	563	563	563	563
%	100	100	100	100	100	100	100	100	100	100	100	100
Incremental benefit	287,130	287,130	287,130	287,130	458,282	458,282	458,282	458,282	458,282	458,282	458,282	458,282
3 Baby Corn												
Benefit	6,074	6,074	6,074	6,074	6,074	6,074	6,074	6,074	6,074	6,074	6,074	6,074
Area	156	156	156	156	156	156	156	156	156	156	156	156
%	200	200	200	200	200	200	200	200	200	200	200	200
Incremental benefit	1,895,088	1,895,088	1,895,088	1,895,088	1,895,088	1,895,088	1,895,088	1,895,088	1,895,088	1,895,088	1,895,088	1,895,088
4 Longbean												
Benefit	1,314	1,314	1,314	1,314	1,314	1,314	1,314	1,314	1,314	1,314	1,314	1,314
Area	156	156	156	156	156	156	156	156	156	156	156	156
%	200	200	200	200	200	200	200	200	200	200	200	200
Incremental benefit	409,968	409,968	409,968	409,968	409,968	409,968	409,968	409,968	409,968	409,968	409,968	409,968
5 Chilli												
Benefit	5,121	5,121	5,121	5,121	5,121	5,121	5,121	5,121	5,121	5,121	5,121	5,121
Area	156	156	156	156	156	156	156	156	156	156	156	156
%	200	200	200	200	200	200	200	200	200	200	200	200
Incremental benefit	1,597,752	1,597,752	1,597,752	1,597,752	1,597,752	1,597,752	1,597,752	1,597,752	1,597,752	1,597,752	1,597,752	1,597,752
6 Fish												
Benefit	10,360	10,360	10,360	10,360	10,360	10,360	10,360	10,360	10,360	10,360	10,360	10,360
Area	16	16	16	16	16	16	16	16	16	16	16	16
%	300	300	300	300	300	300	300	300	300	300	300	300
Incremental benefit	497,280	497,280	497,280	497,280	497,280	497,280	497,280	497,280	497,280	497,280	497,280	497,280
Total With Benefit(1,000baht)	4,903	4,903	4,903	4,903	5,943	5,943	5,943	5,943	5,943	5,943	5,943	5,943
B. Without Project												
1 Casheunut												
Benefit	271	271	271	271	271	271	271	271	271	271	271	271
Area	94	94	94	94	94	94	94	94	94	94	94	94
%	100	100	100	100	100	100	100	100	100	100	100	100
Benefit	25,474	25,474	25,474	25,474	25,474	25,474	25,474	25,474	25,474	25,474	25,474	25,474
2 Forage												
Benefit	18	18	18	18	18	18	18	18	18	18	18	18
Area	625	625	625	625	625	625	625	625	625	625	625	625
%	100	100	100	100	100	100	100	100	100	100	100	100
Benefit	11,250	11,250	11,250	11,250	11,250	11,250	11,250	11,250	11,250	11,250	11,250	11,250
3 Total Without Benefit(1000Baht)	37	37	37	37	37	37	37	37	37	37	37	37
Incremental Benefit(1000Baht) A-B	4,866	4,866	4,866	4,866	5,906	5,906	5,906	5,906	5,906	5,906	5,906	5,906

Table I-3-18 Incremental Benefit of Muno-Koknai

Crops	Project Year											
	3	4	5	6	7	8	9	10	11	12		
Area: Muno-koknai												
Crops												
A. With Project												
1 Paddy(wet)												
Benefit	308	308	308	308	308	308	308	308	308	308	308	308
Area	2,158	2,158	2,158	2,158	2,158	2,158	2,158	2,158	2,158	2,158	2,158	2,158
%	100	100	100	100	100	100	100	100	100	100	100	100
Benefit	664,664	664,664	664,664	664,664	664,664	664,664	664,664	664,664	664,664	664,664	664,664	664,664
Benefit	510	510	510	510	510	510	510	510	510	510	510	510
Area	647	647	647	647	647	647	647	647	647	647	647	647
%	100	100	100	100	100	100	100	100	100	100	100	100
Benefit	330,174	330,174	330,174	330,174	330,174	330,174	330,174	330,174	330,174	330,174	330,174	330,174
3 Coconut												
Benefit	-894	-431	-431	-431	1,915	2,217	2,217	2,217	2,217	2,217	2,217	2,217
Area	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
%	100	100	100	100	100	100	100	100	100	100	100	100
Benefit	-894,000	-431,000	-431,000	-431,000	1,915,000	2,217,000	2,217,000	2,217,000	2,217,000	2,217,000	2,217,000	2,217,000
4 Baby Corn												
Benefit	6,554	6,554	6,554	6,554	6,554	6,554	6,554	6,554	6,554	6,554	6,554	6,554
Area	113	113	113	113	113	113	113	113	113	113	113	113
%	200	200	200	200	200	200	200	200	200	200	200	200
Benefit	1,481,204	1,481,204	1,481,204	1,481,204	1,481,204	1,481,204	1,481,204	1,481,204	1,481,204	1,481,204	1,481,204	1,481,204
5 Longbean												
Benefit	1,874	1,874	1,874	1,874	1,874	1,874	1,874	1,874	1,874	1,874	1,874	1,874
Area	113	113	113	113	113	113	113	113	113	113	113	113
%	200	200	200	200	200	200	200	200	200	200	200	200
Benefit	423,524	423,524	423,524	423,524	423,524	423,524	423,524	423,524	423,524	423,524	423,524	423,524
6 Chili												
Benefit	7,521	7,521	7,521	7,521	7,521	7,521	7,521	7,521	7,521	7,521	7,521	7,521
Area	113	113	113	113	113	113	113	113	113	113	113	113
%	200	200	200	200	200	200	200	200	200	200	200	200
Benefit	1,699,746	1,699,746	1,699,746	1,699,746	1,699,746	1,699,746	1,699,746	1,699,746	1,699,746	1,699,746	1,699,746	1,699,746
7 Pineapple												
Benefit	-229	2,603	2,603	2,603	2,603	2,603	2,603	2,603	2,603	2,603	2,603	2,603
Area	600	600	600	600	600	600	600	600	600	600	600	600
%	100	100	100	100	100	100	100	100	100	100	100	100
Incremental benefit	-137,400	1,561,800	1,561,800	1,561,800	1,561,800	1,561,800	1,561,800	1,561,800	1,561,800	1,561,800	1,561,800	1,561,800
8 Forage												
Benefit	87	87	87	87	87	87	87	87	87	87	87	87
Area	644	644	644	644	644	644	644	644	644	644	644	644
%	100	100	100	100	100	100	100	100	100	100	100	100
Benefit	56,028	56,028	56,028	56,028	56,028	56,028	56,028	56,028	56,028	56,028	56,028	56,028
9 Fish												
Benefit	10,360	10,360	10,360	10,360	10,360	10,360	10,360	10,360	10,360	10,360	10,360	10,360
Area	21	21	21	21	21	21	21	21	21	21	21	21
%	300	300	300	300	300	300	300	300	300	300	300	300
Benefit	652,680	652,680	652,680	652,680	652,680	652,680	652,680	652,680	652,680	652,680	652,680	652,680
10 Inundation prevention												
Benefit	856	856	856	856	856	856	856	856	856	856	856	856
Area	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000
%	10	10	10	10	10	10	10	10	10	10	10	10
Benefit	428,000	428,000	428,000	428,000	428,000	428,000	428,000	428,000	428,000	428,000	428,000	428,000
11 Total With Benefit (1,000pahi)	4,705	6,867	6,867	6,867	9,257	9,257	9,257	9,257	9,257	9,257	9,257	9,257

B. Without Project																			
1 Paddy(wet)																			
Benefit	Baht/rai	-100	-100	-100	-100	-100	-100	-100	-100	-100	-100	-100	-100	-100	-100	-100	-100	-100	-100
Area	rai	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94
%	%	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Benefit		-9,400	-9,400	-9,400	-9,400	-9,400	-9,400	-9,400	-9,400	-9,400	-9,400	-9,400	-9,400	-9,400	-9,400	-9,400	-9,400	-9,400	-9,400
2 Para Rubber																			
Benefit	Baht/rai	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39
Area	rai	131	131	131	131	131	131	131	131	131	131	131	131	131	131	131	131	131	131
%	%	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Benefit		5,109	5,109	5,109	5,109	5,109	5,109	5,109	5,109	5,109	5,109	5,109	5,109	5,109	5,109	5,109	5,109	5,109	5,109
3 Coconut																			
Benefit	Baht/rai	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273
Area	rai	588	588	588	588	588	588	588	588	588	588	588	588	588	588	588	588	588	588
%	%	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Benefit		160,524	160,524	160,524	160,524	160,524	160,524	160,524	160,524	160,524	160,524	160,524	160,524	160,524	160,524	160,524	160,524	160,524	160,524
4 Forage																			
Benefit	Baht/rai	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18
Area	rai	625	625	625	625	625	625	625	625	625	625	625	625	625	625	625	625	625	625
%	%	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Benefit		11,250	11,250	11,250	11,250	11,250	11,250	11,250	11,250	11,250	11,250	11,250	11,250	11,250	11,250	11,250	11,250	11,250	11,250
5 Total Without Benefit(1000Baht)		167	167	167	167	167	167	167	167	167	167	167	167	167	167	167	167	167	167
Incremental Benefit(1000Baht) A-B		4,537	6,699	6,699	6,699	9,089	9,391	9,391	9,391	9,391	9,391	9,391	9,391	9,391	9,391	9,391	9,391	9,391	9,391

Table I-3-19 Incremental Benefit of Bacho Development Type

Area; Bacho	Project Year												
	3	4	5	6	7	8	9	10	11	12	Unit		
Crops													
A. With project													
1 Paddy(wet)													
Benefit	308	308	308	308	308	308	308	308	308	308	308	308	308
Area	8,671	8,671	8,671	8,671	8,671	8,671	8,671	8,671	8,671	8,671	8,671	8,671	8,671
%	100	100	100	100	100	100	100	100	100	100	100	100	100
Benefit	2,670,668	2,670,668	2,670,668	2,670,668	2,670,668	2,670,668	2,670,668	2,670,668	2,670,668	2,670,668	2,670,668	2,670,668	2,670,668
2 Baby Corn													
Benefit	6,074	6,074	6,074	6,074	6,074	6,074	6,074	6,074	6,074	6,074	6,074	6,074	6,074
Area	1,231	1,231	1,231	1,231	1,231	1,231	1,231	1,231	1,231	1,231	1,231	1,231	1,231
%	200	200	200	200	200	200	200	200	200	200	200	200	200
Benefit	14,954,188	14,954,188	14,954,188	14,954,188	14,954,188	14,954,188	14,954,188	14,954,188	14,954,188	14,954,188	14,954,188	14,954,188	14,954,188
3 Longbean													
Benefit	1,314	1,314	1,314	1,314	1,314	1,314	1,314	1,314	1,314	1,314	1,314	1,314	1,314
Area	1,231	1,231	1,231	1,231	1,231	1,231	1,231	1,231	1,231	1,231	1,231	1,231	1,231
%	200	200	200	200	200	200	200	200	200	200	200	200	200
Benefit	3,235,068	3,235,068	3,235,068	3,235,068	3,235,068	3,235,068	3,235,068	3,235,068	3,235,068	3,235,068	3,235,068	3,235,068	3,235,068
4 Chili													
Benefit	3,921	3,921	3,921	3,921	3,921	3,921	3,921	3,921	3,921	3,921	3,921	3,921	3,921
Area	1,231	1,231	1,231	1,231	1,231	1,231	1,231	1,231	1,231	1,231	1,231	1,231	1,231
%	200	200	200	200	200	200	200	200	200	200	200	200	200
Benefit	9,653,502	9,653,502	9,653,502	9,653,502	9,653,502	9,653,502	9,653,502	9,653,502	9,653,502	9,653,502	9,653,502	9,653,502	9,653,502
5 Pineapple													
Benefit	-229	2,603	2,603	2,603	2,603	2,603	-229	2,603	2,603	2,603	2,603	2,603	2,603
Area	4,692	4,692	4,692	4,692	4,692	4,692	3,754	4,692	3,754	3,754	3,754	3,754	3,754
%	100	100	100	100	100	100	100	100	100	100	100	100	100
Benefit	-1,074,468	12,213,276	12,213,276	12,213,276	12,213,276	12,213,276	-859,666	12,213,276	9,771,662	9,771,662	9,771,662	9,771,662	9,771,662
6 Forage													
Benefit	78	78	78	78	78	78	78	78	78	78	78	78	78
Area	1,012	1,012	1,012	1,012	1,012	1,012	1,012	1,012	1,012	1,012	1,012	1,012	1,012
%	100	100	100	100	100	100	100	100	100	100	100	100	100
Benefit	78,936	78,936	78,936	78,936	78,936	78,936	78,936	78,936	78,936	78,936	157,872	157,872	157,872
7 Fish													
Benefit	10,360	10,360	10,360	10,360	10,360	10,360	10,360	10,360	10,360	10,360	10,360	10,360	10,360
Area	161	161	161	161	161	161	161	161	161	161	161	161	161
%	300	300	300	300	300	300	300	300	300	300	300	300	300
Benefit	5,003,880	5,003,880	5,003,880	5,003,880	5,003,880	5,003,880	5,003,880	5,003,880	5,003,880	5,003,880	5,003,880	5,003,880	5,003,880
Total With Benefit(1000Bakt)	34,522	47,810	47,810	47,810	47,810	47,810	34,737	45,368	45,447	45,447	45,447	45,447	45,447
B. Without project													
1 Total Without Benefit	0	0	0	0	0	0	0	0	0	0	0	0	0
Incremental Benefit(1000Bakt) A-B	34,522	47,810	47,810	47,810	47,810	47,810	34,737	45,368	45,447	45,447	45,447	45,447	45,447

Table I-3-20 Incremental Benefit of Kab Daeng Development Type

Crops	Project Year											
	3	4	5	6	7	8	9	10	11	12		
Area: Kab-daeng												
Unit												
A. With Project												
1 Paddy(wet)												
Benefit	308	308	308	308	308	308	308	308	308	308	308	308
Area	8,530	8,530	8,530	8,530	8,530	8,530	8,530	8,530	8,530	8,530	8,530	8,530
%	100	100	100	100	100	100	100	100	100	100	100	100
Incremental benefit	2,627,240	2,627,240	2,627,240	2,627,240	2,627,240	2,627,240	2,627,240	2,627,240	2,627,240	2,627,240	2,627,240	2,627,240
2 Paddy(dry)												
Benefit	510	510	510	510	510	510	510	510	510	510	510	510
Area	2,365	2,365	2,365	2,365	2,365	2,365	2,365	2,365	2,365	2,365	2,365	2,365
%	100	100	100	100	100	100	100	100	100	100	100	100
Incremental benefit	1,206,150	1,206,150	1,206,150	1,206,150	1,206,150	1,206,150	1,206,150	1,206,150	1,206,150	1,206,150	1,206,150	1,206,150
3 Baby Corn												
Benefit	6,074	6,074	6,074	6,074	6,074	6,074	6,074	6,074	6,074	6,074	6,074	6,074
Area	655	655	655	655	655	655	655	655	655	655	655	655
%	200	200	200	200	200	200	200	200	200	200	200	200
Incremental benefit	7,959,370	7,959,370	7,959,370	7,959,370	7,959,370	7,959,370	7,959,370	7,959,370	7,959,370	7,959,370	7,959,370	7,959,370
4 Longbean												
Benefit	1,314	1,314	1,314	1,314	1,314	1,314	1,314	1,314	1,314	1,314	1,314	1,314
Area	655	655	655	655	655	655	655	655	655	655	655	655
%	200	200	200	200	200	200	200	200	200	200	200	200
Incremental benefit	1,721,866	1,721,866	1,721,866	1,721,866	1,721,866	1,721,866	1,721,866	1,721,866	1,721,866	1,721,866	1,721,866	1,721,866
5 Chilli												
Benefit	5,121	5,121	5,121	5,121	5,121	5,121	5,121	5,121	5,121	5,121	5,121	5,121
Area	655	655	655	655	655	655	655	655	655	655	655	655
%	200	200	200	200	200	200	200	200	200	200	200	200
Incremental benefit	6,710,558	6,710,558	6,710,558	6,710,558	6,710,558	6,710,558	6,710,558	6,710,558	6,710,558	6,710,558	6,710,558	6,710,558
6 Fish												
Benefit	10,360	10,360	10,360	10,360	10,360	10,360	10,360	10,360	10,360	10,360	10,360	10,360
Area	67	67	67	67	67	67	67	67	67	67	67	67
%	300	300	300	300	300	300	300	300	300	300	300	300
Incremental benefit	2,088,576	2,088,576	2,088,576	2,088,576	2,088,576	2,088,576	2,088,576	2,088,576	2,088,576	2,088,576	2,088,576	2,088,576
Total With Benefit (1,000baht)	20,592	20,592	20,592	20,592	20,592	20,592	20,592	20,592	20,592	20,592	20,592	20,592
B. Without Project												
1 Casheunut												
Benefit	271	271	271	271	271	271	271	271	271	271	271	271
Area	395	395	395	395	395	395	395	395	395	395	395	395
%	100	100	100	100	100	100	100	100	100	100	100	100
Benefit	106,991	106,991	106,991	106,991	106,991	106,991	106,991	106,991	106,991	106,991	106,991	106,991
2 Forage												
Benefit	18	18	18	18	18	18	18	18	18	18	18	18
Area	2,625	2,625	2,625	2,625	2,625	2,625	2,625	2,625	2,625	2,625	2,625	2,625
%	100	100	100	100	100	100	100	100	100	100	100	100
Benefit	47,250	47,250	47,250	47,250	47,250	47,250	47,250	47,250	47,250	47,250	47,250	47,250
3 Total Without Benefit(1000Baht)	154	154	154	154	154	154	154	154	154	154	154	154
Incremental Benefit(1000Baht) A-B	20,438	20,438	20,438	20,438	20,438	20,438	20,438	20,438	20,438	20,438	20,438	20,438

Table I-3-21 Incremental Benefit of Muno-Koknai Development Type

Area: Muno-koknai	Project Year												
	3	4	5	6	7	8	9	10	11	12			
Crops	Unit												
A. With Project													
1 Paddy(wet)													
Benefit	308	308	308	308	891	891	891	891	891	891	891	891	891
Area	4,316	4,316	4,316	4,316	4,316	4,316	4,316	4,316	4,316	4,316	4,316	4,316	4,316
%	100	100	100	100	100	100	100	100	100	100	100	100	100
Benefit	1,329,328	1,329,328	1,329,328	1,329,328	3,845,556	3,845,556	3,845,556	3,845,556	3,845,556	3,845,556	3,845,556	3,845,556	3,845,556
Benefit	510	510	510	510	1,047	1,047	1,047	1,047	1,047	1,047	1,047	1,047	1,047
Area	2,590	2,590	2,590	2,590	2,590	2,590	2,590	2,590	2,590	2,590	2,590	2,590	2,590
%	100	100	100	100	100	100	100	100	100	100	100	100	100
Benefit	1,320,900	1,320,900	1,320,900	1,320,900	2,711,730	2,711,730	2,711,730	2,711,730	2,711,730	2,711,730	2,711,730	2,711,730	2,711,730
3 Coconut													
Benefit	-894	-431	-431	-431	1,915	2,217	2,217	2,217	2,217	2,217	2,217	2,217	2,217
Area	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
%	100	100	100	100	100	100	100	100	100	100	100	100	100
Benefit	-1,788,000	-862,000	-862,000	-862,000	3,830,000	4,434,000	4,434,000	4,434,000	4,434,000	4,434,000	4,434,000	4,434,000	4,434,000
4 Baby Corn													
Benefit	6,554	6,554	6,554	6,554	6,554	6,554	6,554	6,554	6,554	6,554	6,554	6,554	6,554
Area	226	226	226	226	226	226	226	226	226	226	226	226	226
%	200	200	200	200	200	200	200	200	200	200	200	200	200
Benefit	2,962,408	2,962,408	2,962,408	2,962,408	2,962,408	2,962,408	2,962,408	2,962,408	2,962,408	2,962,408	2,962,408	2,962,408	2,962,408
5 Longbean													
Benefit	1,874	1,874	1,874	1,874	1,874	1,874	1,874	1,874	1,874	1,874	1,874	1,874	1,874
Area	226	226	226	226	226	226	226	226	226	226	226	226	226
%	200	200	200	200	200	200	200	200	200	200	200	200	200
Benefit	847,048	847,048	847,048	847,048	847,048	847,048	847,048	847,048	847,048	847,048	847,048	847,048	847,048
6 Chillii													
Benefit	7,521	7,521	7,521	7,521	7,521	7,521	7,521	7,521	7,521	7,521	7,521	7,521	7,521
Area	226	226	226	226	226	226	226	226	226	226	226	226	226
%	200	200	200	200	200	200	200	200	200	200	200	200	200
Benefit	3,399,492	3,399,492	3,399,492	3,399,492	3,399,492	3,399,492	3,399,492	3,399,492	3,399,492	3,399,492	3,399,492	3,399,492	3,399,492
7 Pinapple													
Benefit	-229	2,603	2,603	2,603	2,603	2,603	2,603	2,603	2,603	2,603	2,603	2,603	2,603
Area	1,200	1,200	1,200	1,200	0	0	0	0	0	0	0	0	0
%	100	100	100	100	100	100	100	100	100	100	100	100	100
Incremental benefit	-274,800	3,123,600	3,123,600	3,123,600	0	0	0	0	0	0	0	0	0
8 Forage													
Benefit	87	87	87	87	87	87	87	87	87	87	87	87	87
Area	1,288	1,288	1,288	1,288	1,288	1,288	1,288	1,288	1,288	1,288	1,288	1,288	1,288
%	100	100	100	100	100	100	100	100	100	100	100	100	100
Benefit	112,056	112,056	112,056	112,056	112,056	112,056	112,056	112,056	112,056	112,056	112,056	112,056	112,056
9 Fish													
Benefit	10,360	10,360	10,360	10,360	10,360	10,360	10,360	10,360	10,360	10,360	10,360	10,360	10,360
Area	42	42	42	42	42	42	42	42	42	42	42	42	42
%	300	300	300	300	300	300	300	300	300	300	300	300	300
Benefit	1,305,360	1,305,360	1,305,360	1,305,360	1,305,360	1,305,360	1,305,360	1,305,360	1,305,360	1,305,360	1,305,360	1,305,360	1,305,360
10 Inundation prebentation													
Benefit	856	856	856	856	856	856	856	856	856	856	856	856	856
Area	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000
%	10	10	10	10	10	10	10	10	10	10	10	10	10
Benefit	428,000	428,000	428,000	428,000	428,000	428,000	428,000	428,000	428,000	428,000	428,000	428,000	428,000
II Total With Benefit (1,000bahi)	9,642	13,966	13,966	13,966	19,442	20,046	20,046	20,046	20,046	20,046	20,046	20,046	20,046

B. Without Project											
1 Paddy(wet)											
Benefit	-100	-100	-100	-100	-100	-100	-100	-100	-100	-100	-100
Area	188	188	188	188	188	188	188	188	188	188	188
%	100	100	100	100	100	100	100	100	100	100	100
Benefit	-18,800	-18,800	-18,800	-18,800	-18,800	-18,800	-18,800	-18,800	-18,800	-18,800	-18,800
2 Para Rubber											
Benefit	39	39	39	39	39	39	39	39	39	39	39
Area	262	262	262	262	262	262	262	262	262	262	262
%	100	100	100	100	100	100	100	100	100	100	100
Benefit	10,218	10,218	10,218	10,218	10,218	10,218	10,218	10,218	10,218	10,218	10,218
3 Coconut											
Benefit	273	273	273	273	273	273	273	273	273	273	273
Area	1,176	1,176	1,176	1,176	1,176	1,176	1,176	1,176	1,176	1,176	1,176
%	100	100	100	100	100	100	100	100	100	100	100
Benefit	321,048	321,048	321,048	321,048	321,048	321,048	321,048	321,048	321,048	321,048	321,048
4 Forage											
Benefit	18	18	18	18	18	18	18	18	18	18	18
Area	1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250
%	100	100	100	100	100	100	100	100	100	100	100
Benefit	22,500	22,500	22,500	22,500	22,500	22,500	22,500	22,500	22,500	22,500	22,500
5 Total Without Benefit(1000Baht)	335	335	335	335	335	335	335	335	335	335	335
Incremental Benefit(1000Baht) A-B	9,307	13,631	13,631	19,107	19,711	19,711	19,711	19,711	19,711	19,711	19,711

Table I-3-22 Crop Budget per Rai for Without Project

		Paddy (wet)		Para Rubber		Coconut		Cashewnut		Forage	
		Financial	Economic	Financial	Economic	Financial	Economic	Financial	Economic	Financial	Economic
1. Out Put											
1-1 Yield per rai	Baht/kg	481	559	1,278	1,656	540	540	500	500	105	105
1-2 By product	Baht/kg	6	6	0	0	0	0	0	0	0	0
1-3 Plant Residue	Baht/kg	39	39	0	0	0	0	0	0	0	0
1-4 Gross Value	Baht/kg	526	604	1,278	1,656	540	540	500	500	105	105
2. Input											
2-1 Seed	Baht/kg	19	22	0	0	0	0	0	0	10	10
2-2 Fertilizer	Baht/kg	0	0	110	100	0	0	0	0	0	0
2-3 Lime dust	Baht/kg	0	0	0	0	0	0	0	0	0	0
2-4 Agro-chemical	Baht/kg	0	0	0	0	0	0	0	0	0	0
2-5 Irrigation	Baht/kg	0	0	0	0	0	0	0	0	0	0
2-6 Hired machinery	Baht/kg	100	92	0	0	0	0	0	0	0	0
2-7 Labor input	Baht/kg	80	570	0	1,440	160	259	0	222	0	74
2-8 Bullocks	Baht/kg	0	0	0	0	0	0	0	0	0	0
2-9 Miscellaneous	Baht/kg	6	21	6	77	5	8	0	7	0	3
3. Total Cost	Baht/kg	205	705	6	1,617	165	267	0	229	10	87
4. Net return		321	-101	1,273	39	375	273	500	271	95	18

Table I-3-23 Crop Budget per Rai for paddy (wet season)-with project-Bacho (1/8)

	Financial Price		Economic Price	
	Quantity	Unit Price	Value	Value
1. Out Put				
1-1 Yield per rai	375 kg/rai	3.7 Baht/kg	1,388 Baht/rai	4.3 Baht/kg
1-2 By product	34	0.5	17	0.5
1-3 Plant Residue	375	0.3	113	0.3
1-4 Gross Value			1,517 Baht/rai	
2. Input				
2-1 Seed	5 kg/rai	3.7 Baht/kg	19 Baht/rai	4.3 Baht/kg
2-2 Fertilizer				
Urea	22	6.1	134	5.7
TSP	23	5.4	124	5.0
MP	8	5.0	40	4.6
2-3 Lime dust ...1/	4,800	0.3	0	-
2-4 Agro-chemical	3	100	300	92
2-5 Irrigation...2/			0	-
2-6 Hired machinery	0.5 day	200 Baht/day	100	184 Baht/day
2-7 Labor input	10.3 m.day	- Baht/day	160	74 Baht/day
Family	8.3 m.day	0	0	74 Baht/day
Hired	2.0 m.day	80 Baht/day	160	74 Baht/day
2-8 Bullocks	0	0	0	0
2-9 Miscellaneous			25	42
2-10 Interest			74	0
3. Total Cost			936	1,434
4. Net return			581	308
5. Loan Requirement...3/			617	0

Note: 1/ Lime dust applies to control pH every 4 years.

Quantity of lime application per rai is differed in each soil series referred to Appendix E.

The cost of lime dust for 1st year is included in land reclamation cost.

2/ Irrigation fee is subsidized by government.

3/ Loan requirement is for initial input cost consisting of seed, fertilizer and chemical.

Table I-3-23 Crop Budget per Rai for Baby Corn-with project-Bacho (2/8)

	Financial Price		Economic Price	
	Quantity	Unit Price	Value	Value
1. Out Put				
1-1 Yield per rai	680 kg/rai	12.0 Baht/kg	8,160 Baht/rai	12.0
1-2 By product	0	0	0	0
1-3 Gross Value			8,160 Baht/rai	8,160
2. Input				
2-1 Seed	3 kg/rai	70 Baht/kg	210 Baht/rai	64
2-2 Fertilizer				
Urea	10	6.1	61	5.7
13-13-21	20	5.1	102	4.6
2-3 Lime dust ...1/	4,800	0.3	0	-
2-4 Agro-chemical	1	100	100	92
2-5 Irrigation...2/			0	-
2-6 Hired machinery	1.2 day	200 Baht/day	240	184
2-7 Labor input	18 m.day	- Baht/day	0	Baht/day
Family	18	0	0	74
Hired	0	80	0	74
2-8 Bullocks	0	0	0	0
2-9 Miscellaneous			36	99
2-10 Interest			57	0
3. Total Cost			805	2,086
4. Net return			7,355	6,074
5. Loan requirement...3/			473	0

Note: 1/ Lime dust applies to control pH every 4 years.

Quantity of lime application per rai is differed in each soil series referred to Appendix E.

2/ Irrigation fee is subsidized by government.

3/ Loan requirement is for initial input cost consisting of seed ,fertilizer,chemical.

Table I-3-23 Crop Budget per Rai for Yard Longbean with project-Bacho (3/8)

Area: Bacho	Financial Price		Economic Price	
	Quantity	Unit Price	Value	Value
1. Out Put				
1-1 Yield per rai	400 kg/rai	7.0 Baht/kg	2,800 Baht/rai	2,800 Baht/rai
1-2 By product	0	0	0	0
1-3 Gross Value			2,800 Baht/rai	2,800
2. Input				
2-1 Seed	3 kg/rai	40 Baht/kg	120 Baht/rai	120
2-2 Fertilizer				
Urea	10	6.1	61	57
13-13-21	20	5.1	102	92
2-3 Lime dust ...1/	3,200	0.3	0	0
2-4 Agro-chemical	1	100	100	92
2-5 Irrigation...2/			0	0
2-6 Hired machinery	0.5 day	200 Baht/day	100	92
2-7 Labor input	13 m.day	- Baht/day	0	Baht/day 962
Family	13	0	0	962
Hired	0	80	0	74
2-8 Bullocks	0	0	0	74
2-9 Miscellaneous			24	71
2-10 Interest			46	0
3. Total Cost			553	1,486
4. Net return			2,247	1,314
5. Loan requirement...3/			383	0

Note: 1/ Lime dust applies to control pH every 4 years.

Quantity of lime application per rai is differed in each soil series referred to Appendix E.

2/ Irrigation fee is subsidized by government.

3/ Loan requirement is for initial input cost consisting of seed, fertilizer, chemical.

Table I-3-23 Crop Budget per Rai for Chillies with project-Bacho (4/8)

Area: Bacho	Financial Price		Economic Price	
	Quantity	Unit Price	Value	Value
1. Out Put				
1-1 Yield per rai	280 kg/rai	30.0 Baht/kg	8,400 Baht/rai	30.0
1-2 By product	0	0	0	0
1-3 Gross Value			8,400 Baht/rai	8,400
2. Input				
2-1 Seed	0.15 kg/rai	1,000 Baht/kg	150 Baht/rai	920
2-2 Fertilizer				
Urea	10	6.1	61	57
13-13-21	20	5.1	102	92
2-3 Lime dust ...1/	4,800	0.3	0	0
2-4 Agro-chemical	0.5	100	50	92
2-5 Irrigation...2/			0	0
2-6 Hired machinery	1.2 day	200 Baht/day	240	184
2-7 Labor input	50 m.day	- Baht/day	0	Baht/day 3,700
Family	50	0	0	74
Hired	0	80	0	74
2-8 Bullocks	0	0	0	74
2-9 Miscellaneous			30	213
2-10 Interest			44	0
3. Total Cost			677	4,479
4. Net return			7,723	3,921
5. Loan Requirement...3/			363	0

Note: 1/ Lime dust applies to control pH every 4 years.

Quantity of lime application per rai is differed in each soil series referred to Appendix E.

The cost of lime dust for 1st year is included in land reclamation cost.

2/ Irrigation fee is subsidized by government.

3/ Loan requirement is for initial input cost consisting of seed, fertilizer, chemical.

Table I-3-23 Crop Budget per Rai for Pineapple (Economic) with project-Bacho (5/8)

Area: Bacho	Unit	1st Year	2-4th Year	5th Year	6th Year
I. Out Put					
1-1 Yield per rai	kg/rai	4,500	4,500	4,500	4,500
1-2 Unit Price	Baht/kg	1.0	1.0	1.0	1.0
1-3 Gross Value	Baht/rai	4,500	4,500	4,500	4,500
2. Input					
2-1 Young tree	plants/rai	4,500	0	0	0
	Baht/rai	2,070	0	0	0
2-2 Manure	Baht/rai	294			
2-3 Fertilizer					
15-15-15	Baht/rai	235	235	235	235
2-4 Lime dust ...1/	Baht/rai	0	0	0	0
2-5 Agro-chemical	Baht/rai	92	92	92	92
2-6 Irrigation...2/	Baht/rai	0	0	0	0
2-7 Hired machinery	Baht/rai	184	0	0	0
2-8 Labor input	m.day	22	20	20	20
	Baht/rai	1,628	1,480	1,480	1,480
2-9 Bullocks	Baht/rai	0	0	0	0
2-10 Miscellaneous	Baht/rai	225	90	90	90
3. Total Cost	Baht/rai	4,729	1,897	1,897	1,897
4. Net return		-229	2,603	2,603	2,603

Note: 1/ Lime dust applies to control pH every 4 years.

Quantity of lime application per rai is differed in each soil series referred to Appendix E.

2/ Irrigation fee is subsidized by government.

Table I-3-23 Crop Budget per Rai for Pineapple (Financial) with project-Bacho (6/8)

Area: Bacho	Unit	1st Year	2-4th Year	5th Year	6th Year
With project(Financial)					
I. Out Put					
1-1 Yield per rai	kg/rai	4,500	4,500	4,500	4,500
1-2 Unit Price	Baht/kg	1.0	1.0	1.0	1.0
1-3 Gross Value	Baht/rai	4,500	4,500	4,500	4,500
2. Input					
2-1 Young tree	plants/rai	4,500	0	0	0
	Baht/rai	2,250	0	0	0
2-2 Manure	Baht/rai	320			
2-3 Fertilizer					
15-15-15	Baht/rai	260	260	260	260
2-4 Lime dust ...1/	Baht/rai	0	0	0	0
2-5 Agro-chemical	Baht/rai	100	100	100	100
2-6 Irrigation...2/	Baht/rai	0	0	0	0
2-7 Hired machinery	Baht/rai	200	0	0	0
2-8 Labor input	m.day	22	20	20	20
	Baht/rai	0	0	0	0
2-9 Bullocks	Baht/rai	0	0	0	0
2-10 Miscellaneous	Baht/rai	157	18	18	18
2-11 Interest		313	157	0	0
3. Total Cost	Baht/rai	3,600	535	378	378
4. Net return		900	3,965	4,122	4,122
5. Loan Requirement...3/		2,610	0	0	0

Note: 1/ Lime dust applies to control pH every 4 years.

Quantity of lime application per rai is differed in each soil series referred to Appendix E.

The cost of lime dust for 1st year is included in land reclamation cost.

2/ Irrigation fee is subsidized by government.

3/ Loan requirement is for initial input cost consisting of nursery, fertilizer, chemical.

Table I-3-23 Crop Budget per Rai for Forage with project-Bacho (7/8)

Area: Bacho	Quantity	Financial Price		Economic Price	
		Unit Price	Value	Unit Price	Value
1. Out Put					
1-1 Yield per rai	550 kg/rai	0.3 Baht/rai	165 Baht/kg	0.3 Baht/kg	165 Baht/rai
1-2 By product	0	0	0	0	0
1-3 Gross Value			165 Baht/rai		165 Baht/rai
2. Input					
2-1 Seed	0.5 kg/rai	20 Baht/rai	10 Baht/kg	18 Baht/kg	9 Baht/rai
2-2 Fertilizer					
Urea	0	6.1	0	5.7	0
TSP	0	5.4	0	5.0	0
MP	0	5.0	0	4.6	0
2-3 Lime dust ...1/	0	0.3	0	-	0
2-4 Agro-chemical	0	100	0	0	0
2-5 Irrigation...2/					
2-6 Hired machinery	0 day	200 Baht/day	0	184 Baht/day	0
2-7 Labor input	1 m.day	- Baht/day	0	74 Baht/day	74
Family	1 m.day	0	0	74 Baht/day	74
Hired	0.0 m.day	80 Baht/day	0	74 Baht/day	0
2-8 Bullocks	0	0	0	0	0
2-9 Miscellaneous			1		4
3. Total Cost			11		87
4. Net return			155		78

Note; 1/ Lime dust applies to control pH every 4 years.

Quantity of lime application per rai is differed in each soil series referred to Appendix to E.

2/ Irrigation fee is subsidized by government.

Table I-3-23 Crop Budget per Rai for Fish (catfish) with project-Bacho (8/8)

Area: Bacho	Quantity	Financial Price		Economic Price	
		Unit Price	Value	Unit Price	Value
1. Out Put					
1-1 Yield per rai	1,500 kg/rai	33 Baht/kg	49,500 Baht/rai	33 Baht/kg	49,500 Baht/rai
1-2 By product	0	0	0	0	0
1-3 Gross Value			49,500 Baht/rai		49,500 Baht/rai
2. Input					
2-2 Fingering	32,000 fs/rai	0.5 Baht/kg	16,000 Baht/rai	0.46 Baht/kg	14,720 Baht/rai
2-3 Lime dust ...1/	3,500	0.3	0	0.276	0
2-4 Pesticide	0.5	1,000	500	920	460
2-5 Irrigation...2/			0	-	0
2-6 Feed	1,600	15	24,000	13.8	22,080
2-7 Labor input	10 m.day	0 Baht/day	0	74 Baht/day	740
Family	10 m.day	0	0	74 Baht/day	740
Hired	0 m.day	80 Baht/day	0	73.6 Baht/day	0
2-8 Bullocks	0	0	0	0	0
2-9 Miscellaneous			1,215		1,140
2-10 Interest			4,860		0
3. Total Cost			41,715		39,140
4. Net return			7,785		10,360
5. Loan Requirement...3/			40,500		0

Not 1/ Lime dust applies 7 tons per rai at 1st year, 3.5 tons at from 2nd to 5 th year,

2/ Irrigation fee is subsidized by government.

3/ Loan requirement is for initial input cost consisting of fingering, pesticide and feed.

Table I-3-24 Crop Budget per Rai for paddy (dry season) with project-Kab Daeng (1/4)
Area: Kab Daeng

	Financial Price		Economic Price	
	Quantity	Unit Price	Value	Value
1. Out Put				
1-1 Yield per rai	435 kg/rai	3.7 Baht/kg	1,610 Baht/rai	1,871 Baht/rai
1-2 By product	39	0.5	20	20
1-3 Plant Residue	435	0.3	131	131
1-4 Gross Value			1,760 Baht/rai	2,021 Baht/rai
2. Input				
2-1 Seed	5 kg/rai	3.7 Baht/kg	19 Baht/rai	22 Baht/rai
2-2 Fertilizer				
Urea	22	6.1	134	125
TSP	23	5.4	124	115
MP	8	5.0	40	37
2-3 Lime dust ...1/	4,800	0.3	0	0
2-4 Agro-chemical	3	100	300	276
2-5 Irrigation...2/			0	0
2-6 Hired machinery	0.5 day	200 Baht/day	100	92
2-7 Labor input	11.3 m.day	Baht/day	160	836
Family	9.3 m.day	0	0	688
Hired	2.0 m.day	80 Baht/day	160	148
2-8 Bullocks	0	0	0	0
2-9 Miscellaneous			25	44
2-10 Interest			74	0
3. Total Cost			936	1,510
4. Net return			824	510
5. Loan Requirement...3/			617	0

Note: 1/ Lime dust applies to control pH every 4 years.

Quantity of lime application per rai is differed in each soil series referred to Appendix E.

The cost of lime dust for 1st year is included in land reclamation cost.

2/ Irrigation fee is subsidized by government.

3/ Loan requirement is for initial input cost consisting of seed, fertilizer and chemical.

Table I-3-24 Crop Budget per Rai for paddy (wet season)-HYV with project-Kab Daeng (2/4)
Area: Kab Daeng

	Financial Price		Economic Price	
	Quantity	Unit Price	Value	Value
1. Out Put				
1-1 Yield per rai	448 kg/rai	3.9 Baht/kg	1,747 Baht/rai	4.5 Baht/kg 2,016 Baht/rai
1-2 By product	40.32	0.5	20	0.5 20
1-3 Plant Residue	448	0.3	134	0.3 134
1-4 Gross Value			1,902 Baht/rai	2,171 Baht/rai
2. Input				
2-1 Seed	5 kg/rai	3.9 Baht/kg	20 Baht/rai	4.5 Baht/kg 23 Baht/rai
2-2 Fertilizer				
Urea	22	6.1	134	5.7 125
TSP	23	5.4	124	5 115
MP	8	5	40	4.5 37
2-3 Lime dust ...1/	4,800	0.3	0	0
2-4 Agro-chemical	3	100	300	92 276
2-5 Irrigation...2/			0	0
2-6 Hired machinery	0.5 day	200 Baht/day	100	184 Baht/day 92
2-7 Labor input	10.3 m.day	Baht/day	160	74 Baht/day 762
Family	8.3 m.day	0	0	74 Baht/day 614
Hired	2 m.day	80 Baht/day	160	74 Baht/day 148
2-8 Bullocks	0	0	0	0
2-9 Miscellaneous			25	42
2-10 Interest			74	0
3. Total Cost			937	1,435
4. Net return			965	736
5. Loan Requirement...3/			618	0

Note: 1/ Lime dust applies to control pH every 4 years.

Quantity of lime application per rai is differed in each soil series referred to Appendix E.

The cost of lime dust for 1st year is included in land reclamation cost.

2/ Irrigation fee is subsidized by government.

3/ Loan requirement is for initial input cost consisting of seed, fertilizer and chemical.

Table I-3-24 Crop Budget per Rai for paddy (dry season)-HYV with project-Kab Daeng (3/4)

	Financial Price			Economic Price		
	Quantity	Unit Price	Value	Unit Price	Value	Value
1. Out Put						
1-1 Yield per rai	480 kg/rai	3.9 Baht/kg	1,872 Baht/rai	4.5 Baht/kg	2,160 Baht/rai	
1-2 By product	43	0.5	22	0.5	22	
1-3 Plant Residue	480	0.3	144	0.3	144	
1-4 Gross Value			2,038 Baht/rai		2,326 Baht/rai	
2. Input						
2-1 Seed	5 kg/rai	3.9 Baht/kg	20 Baht/rai	4.5 Baht/kg	23 Baht/rai	
2-2 Fertilizer						
Urea	22	6.1	134	5.7	125	
TSP	23	5.4	124	5.0	115	
MP	8	5.0	40	4.6	37	
2-3 Lime dust ...1/	4,800	0.3	0	-	0	
2-4 Agro-chemical	3	100	300	92	276	
2-5 Irrigation...2/			0	-	0	
2-6 Hired machinery	0.5 day	200 Baht/day	100	184 Baht/day	92	
2-7 Labor input	11.3 m.day	- Baht/day	160	74 Baht/day	836	
Family	9.3 m.day	0	0	74 Baht/day	688	
Hired	2.0 m.day	80 Baht/day	160	74 Baht/day	148	
2-8 Bullocks	0	0	0	0	0	
2-9 Miscellaneous			25		44	
2-10 Interest			74		0	
3. Total Cost			937		1,511	
4. Net return			1,100		814	
5. Loan Requirement...3/			618		0	

Note: 1/ Lime dust applies to control pH every 4 years.

Quantity of lime application per rai is differed in each soil series referred to Appendix E.

The cost of lime dust for 1st year is included in land reclamation cost.

Table I-3-24 Crop Budget per Rai for Chillies with project-Kab Daeng (4/4)

	Financial Price			Economic Price		
	Quantity	Unit Price	Value	Unit Price	Value	Value
1. Out Put						
1-1 Yield per rai	320 kg/rai	30 Baht/kg	9,600 Baht/rai	30	9,600 Baht/rai	
1-2 By product	0	0	0	0	0	
1-3 Gross Value			9,600 Baht/rai		9,600 Baht/rai	
2. Input						
2-1 Seed	0.15 kg/rai	1,000 Baht/kg	150 Baht/rai	920	150 Baht/rai	
2-2 Fertilizer						
Urea	10	6.1	61	5.7	57	
13-13-21	20	5.1	102	4.6	92	
2-3 Lime dust ...1/	4,800	0.3	0	-	0	
2-4 Agro-chemical	0.5	100	50	92	46	
2-5 Irrigation...2/			0	-	0	
2-6 Hired machinery	1.2 day	200 Baht/day	240	184	221	
2-7 Labor input	50 m.day	- Baht/day	0	Baht/day	3,700	
Family	50	0	0	74	3,700	
Hired	0	80	0	74	0	
2-8 Bullocks	0	0	0	0	0	
2-9 Miscellaneous			30		213	
2-10 Interest			44		0	
3. Total Cost			677		4,479	
4. Net return			8,923		5,121	
5. Loan Requirement...3/			363		0	

Note: 1/ Lime dust applies to control pH every 4 years.

Quantity of lime application per rai is differed in each soil series referred to Appendix E.

The cost of lime dust for 1st year is included in land reclamation cost.

2/ Irrigation fee is subsidized by government.

Table 1-3-25 Crop Budget per Rai for paddy (wet season)-HYV with project-Muno Koknrai (1/7)

	Financial Price		Economic Price	
	Quantity	Unit Price	Value	Unit Price
1. Out Put				
1-1 Yield per rai	480 kg/rai	3.9 Baht/kg	1,872 Baht/rai	4.5 Baht/kg
1-2 By product	43	0.5	22	0.5
1-3 Plant Residue	480	0.3	144	0.3
1-4 Gross Value			2,038 Baht/rai	2,326 Baht/rai
2. Input				
2-1 Seed	5 kg/rai	3.9 Baht/kg	20 Baht/rai	4.5 Baht/kg
2-2 Fertilizer				
Urea	22	6.1	134	5.7
TSP	23	5.4	124	5.0
MP	8	5.0	40	4.6
2-3 Lime dust ...1/	4,800	0.3	0	-
2-4 Agro-chemical	3	100	300	92
2-5 Irrigation...2/			0	-
2-6 Hired machinery	0.5 day	200 Baht/day	100	184 Baht/day
2-7 Labor input	10.3 m.day	- Baht/day	160	74 Baht/day
Family	8.3 m.day	0		74 Baht/day
Hired	2.0 m.day	80 Baht/day	160	74 Baht/day
2-8 Bullocks	0	0	0	0
2-9 Miscellaneous			25	42
2-10 Interest			74	0
3. Total Cost			937	1,435
4. Net return			1,100	891
5. Loan Requirement...3/			618	0

Note: 1/ Lime dust applies to control pH every 4 years.

Quantity of lime application per rai is differed in each soil series referred to Appendix E.

The cost of lime dust for 1st year is included in land reclamation cost.

2/ Irrigation fee is subsidized by government.

3/ Loan requirement is for initial input cost consisting of seed, fertilizer and chemical.

Table 1-3-25 Crop Budget per Rai for paddy (dry season)-HYV with project-Muno Koknrai (2/7)

	Financial Price		Economic Price	
	Quantity	Unit Price	Value	Unit Price
1. Out Put				
1-1 Yield per rai	528 kg/rai	3.9 Baht/kg	2,059 Baht/rai	4.5 Baht/kg
1-2 By product	47.52	0.5	24	0.5
1-3 Plant Residue	528	0.3	158	0.3
1-4 Gross Value			2,241 Baht/rai	2,558 Baht/rai
2. Input				
2-1 Seed	5 kg/rai	3.9 Baht/kg	20 Baht/rai	4.5 Baht/kg
2-2 Fertilizer				
Urea	22	6.1	134	5.7
TSP	23	5.4	124	5
MP	8	5	40	4.6
2-3 Lime dust ...1/	4,800	0.3	0	-
2-4 Agro-chemical	3	100	300	92
2-5 Irrigation...2/			0	-
2-6 Hired machinery	0.5 day	200 Baht/day	100	184 Baht/day
2-7 Labor input	11.3 m.day	- Baht/day	160	74 Baht/day
Family	9.3 m.day	0		74 Baht/day
Hired	2 m.day	80 Baht/day	160	74 Baht/day
2-8 Bullocks	0	0	0	0
2-9 Miscellaneous			25	44
2-10 Interest			74	0
3. Total Cost			937	1,511
4. Net return			1,304	1,047
5. Loan Requirement...3/			618	0

Note: 1/ Lime dust applies to control pH every 4 years.

Quantity of lime application per rai is differed in each soil series referred to Appendix E.

The cost of lime dust for 1st year is included in land reclamation cost.

2/ Irrigation fee is subsidized by government.

3/ Loan requirement is for initial input cost consisting of seed, fertilizer and chemical.

Table I-3-25 Crop Budget per Rai for Baby Corn with project-Muno Koknai (3/7)

Area: Muno Koknai	Financial Price			Economic Price		
	Quantity	Unit Price	Value	Quantity	Unit Price	Value
1. Out Put						
1-1 Yield per rai	720 kg/rai	12.0 Baht/kg	8,640 Baht/rai	12.0		8,640 Baht/rai
1-2 By product	0	0	0	0		0
1-3 Gross Value			8,640 Baht/rai			8,640
2. Input						
2-1 Seed	3 kg/rai	70 Baht/kg	210 Baht/rai	64		193
2-2 Fertilizer						
Urea	10	6.1	61	5.7		57
13-13-21	20	5.1	102	4.6		92
2-3 Lime dust ...1/	4,800	0.3	0	-		0
2-4 Agro-chemical	1	100	100	92		92
2-5 Irrigation...2/			0	-		0
2-6 Hired machinery	1.2 day	200 Baht/day	240	184		221
2-7 Labor input	18 m.day	- Baht/day	0	Baht/day	1,332	1,332
Family	18	0	0	74		1,332
Hired	0	80	0	74		0
2-8 Bullocks	0	0	0			0
2-9 Miscellaneous			36			99
2-10 Interest			57			0
3. Total Cost			805			2,086
4. Net return			7,835			6,554
5. Loan requirement...3/			473			0

Note; 1/ Lime dust applies to control pH every 4 years.

Quantity of lime application per rai is differed in each soil series referred to Appendix E.

2/ Irrigation fee is subsidized by government.

3/ Loan requirement is for initial input cost consisting of seed ,fertilizer,chemical.

Table I-3-25 Crop Budget per Yard Longbean with project-Muno Koknai (4/7)

Area: Muno Koknai	Financial Price			Economic Price		
	Quantity	Unit Price	Value	Quantity	Unit Price	Value
1. Out Put						
1-1 Yield per rai	480 kg/rai	7 Baht/kg	3,360 Baht/rai	7		3,360 Baht/rai
1-2 By product	0	0	0	0		0
1-3 Gross Value			3,360 Baht/rai			3,360
2. Input						
2-1 Seed	3 kg/rai	40 Baht/kg	120 Baht/rai	36.8		120
2-2 Fertilizer						
Urea	10	6.1	61	5.7		57
13-13-21	20	5.1	102	4.6		92
2-3 Lime dust ...1/	3,200	0.3	0	-		0
2-4 Agro-chemical	1	100	100	92		92
2-5 Irrigation...2/			0	-		0
2-6 Hired machinery	0.5 day	200 Baht/day	100	184		92
2-7 Labor input	13 m.day	- Baht/day	0	Baht/day	962	962
Family	13	0	0	74		962
Hired	0	80	0	74		0
2-8 Bullocks	0	0	0			0
2-9 Miscellaneous			24			71
2-10 Interest			46			0
3. Total Cost			553			1,486
4. Net return			2,807			1,874
5. Loan requirement...3/			383			0

Note; 1/ Lime dust applies to control pH every 4 years.

Quantity of lime application per rai is differed in each soil series referred to Appendix E.

2/ Irrigation fee is subsidized by government.

3/ Loan requirement is for initial input cost consisting of seed, fertilizer,chemical.

Table 1-3-25 Crop Budget per Rai for Coconut (Economic) with project-Muno koknai (5/7)

Area: Bacho	Unit	1st Year	2nd Year	3 Year	4 Year	5 Year	6 Year-
1. Out Put							
1-1 Yield per rai	Fruits/rai	0	0	0	0	520	600
1-2 Unit Price	Baht/Fruit	5.0	5.0	5.0	5.0	5.0	5.0
1-3 Gross Value	Baht/rai	0	0	0	0	2,600	3,000
2. Input							
2-1 Nursery	plants/rai	20	0	0	0	0	0
	Baht/rai	147	0	0	0	0	0
2-2 Manure	Baht/rai	102					
2-3 Fertilizer							
15-15-15	kg/plant	1.0	2.0	2.0	2.0	3.0	4.0
	Baht/rai	94	188	188	188	282	376
2-4 Lime dust ...1/	Baht/rai	0	0	0	0	0	0
2-5 Agro-chemical	Baht/rai	0	0	0	0	0	0
2-6 Irrigation...2/	Baht/rai	0	0	0	0	0	0
2-7 Hired machinery	Baht/rai	138	0	0	0	0	0
2-8 Labor input	m.day	5.0	3.0	3.0	3.0	5.0	5.0
	Baht/rai	370	222	222	222	370	370
2-9 Bullocks	Baht/rai	0	0	0	0	0	0
2-10 Miscellaneous	Baht/rai	43	21	21	21	33	37
3. Total Cost	Baht/rai	894	431	431	431	685	783
4. Net return...3/		-894	-431	-431	-431	1,915	2,217

Note: 1/ Lime dust applies to control pH every 4 years.

Quantity of lime application per rai is differed in each soil series referred to Appendix E.

2/ Irrigation fee is subsidized by government.

3/ Figure in parenthesis is calculated without lime dust.

Table 1-3-25 Crop Budget per Rai for Coconut (Financial) with project-Muno koknai (6/7)

Area: Bacho	Unit	1st Year	2nd Year	3 Year	4 Year	5 Year	6 Year-
1. Out Put							
1-1 Yield per rai	Fruits/rai	0	0	0	0	520	600
1-2 Unit Price	Baht/Fruit	5.0	5.0	5.0	5.0	5.0	5.0
1-3 Gross Value	Baht/rai	0	0	0	0	2,600	3,000
2. Input							
2-1 Nursery	plants/rai	20	0	0	0	0	0
	Baht/rai	160	0	0	0	0	0
2-2 Manure	Baht/rai	110					
2-3 Fertilizer							
15-15-15	kg/plant	1.0	2.0	2.0	2.0	3.0	4.0
	Baht/rai	104	208	208	208	312	416
2-4 Lime dust ...1/	Baht/rai	0	0	0	0	0	0
2-5 Agro-chemical	Baht/rai	0	0	0	0	0	0
2-6 Irrigation...2/	Baht/rai	0	0	0	0	0	0
2-7 Hired machinery	Baht/rai	150	0	0	0	0	0
2-8 Labor input	m.day	5.0	3.0	3.0	3.0	5.0	5.0
	Baht/rai	400	240	240	240	400	400
2-9 Bullocks	Baht/rai	0	0	0	0	0	0
2-10 Miscellaneous	Baht/rai	46	22	22	22	36	41
2-11 Interest		16	8	8	8	0	0
3. Total Cost	Baht/rai	986	478	470	470	748	857
4. Net return		-986	-478	-470	-470	1,852	2,143
5. Loan Requirement...3/		264	0	0	0	0	0

Note: 1/ Lime dust applies to control pH every 4 years.

Quantity of lime application per rai is differed in each soil series referred to Appendix E.
The cost of lime dust 1st year is included in land reclamation cost.

2/ Irrigation fee is subsidized by government.

3/ Loan requirement is for initial input cost consisting of nursery, fertilizer and chemical.

Table 1-3-25 Crop Budget per Rai for Chillies with project-Muno koknai (7/7)

	Quantity	Financial Price		Economic Price	
		Unit Price	Value	Unit Price	Value
1. Out Put					
1-1 Yield per rai	400 kg/rai	30.0 Baht/kg	12,000 Baht/rai	30.0	12,000 Baht/rai
1-2 By product	0	0	0	0	0
1-3 Gross Value			12,000 Baht/rai		12,000
2. Input					
2-1 Seed	0.15 kg/rai	1,000 Baht/kg	150 Baht/rai	920	150
2-2 Fertilizer					
Urea	10	6.1	61	5.7	57
13-13-21	20	5.1	102	4.6	92
2-3 Lime dust ...1/	4,800	0.3	0	-	0
2-4 Agro-chemical	0.5	100	50	92	46
2-5 Irrigation...2/			0	-	0
2-6 Hired machinery	1.2 day	200 Baht/day	240	184	221
2-7 Labor input	50 m.day	Baht/day	0	Baht/day	3,700
Family	50	0		74	3,700
Hired	0	80	0	74	0
2-8 Bullocks	0	0	0	0	0
2-9 Miscellaneous			30		213
2-10 Interest			44		0
3. Total Cost			677		4,479
4. Net return			11,323		7,521
5. Loan Requirement...3/			363		0

Note: 1/ Lime dust applies to control pH every 4 years.

Quantity of lime application per rai is differed in each soil series referred to Appendix E.

The cost of lime dust for 1st year is included in land reclamation cost

2/ Irrigation fee is subsidized by government

3/ Loan requirement is for initial input cost consisting of seed, fertilizer, chemical.

Table I-3-26 Inundation Prevention Benefit

Area; around the Muno-koknai		Without project (Under flood risk)			
	Quantity	Financial Price		Economic Price	
		Unit Price	Value	Unit Price	Value
1. Out Put					
1-1 Yield per rai	350 kg/rai	3.7 Baht/kg	1,295 Baht/rai	4.3 Baht/kg	1,505 Baht/rai
1-2 By product	32	0.5	16	0.5	16
1-3 Plant Residue	350	0.3	105	0.3	105
1-4 Gross Value			1,416 Baht/rai		1,626 Baht/rai
2. Input					
2-1 Seed	5 kg/rai	3.7 Baht/kg	19 Baht/rai	4.3 Baht/kg	22 Baht/rai
2-2 Fertilizer			84		78
2-3 Lime dust	0	0.3	0		0
2-4 Agro-chemical	0	100	0	92	0
2-5 Irrigation			0		0
2-6 Hired machinery	0.5 day	200 Baht/day	100	184 Baht/day	92
2-7 Labor input	7.7 m.day	Baht/day	136	74 Baht/day	570
2-8 Bullocks	0	0	0		0
2-9 Miscellaneous			10		22
3. Total Cost			333		770
4. Net return			1,083		856
5. Damage Loss	10%		108		86
6. Area	5,000rai				
7. Inundation Prevention Benefit			541,000		428,000

Table I-3-27 Economic Cash Flow Of Bacho F/S Area

No	Year	Cost		Benefit		1.0% of discount		2.0% of discount		(1,000 Bahts)	
		Initial	O&M Replacement	Total	Gross	Net	Cost	Benefit	Net benefit		Cost
1	1994	4,934	0	4,934	0	-4,934	4,885	0	4,837	0	-4,837
2	1995	25,475	0	25,475	0	-25,475	24,973	0	24,486	0	-24,486
3	1996	30,045	0	30,045	3,001	-27,044	29,161	2,913	28,312	2,828	-25,484
4	1997	16,150	0	16,150	4,156	-11,994	15,520	3,994	14,920	3,840	-11,081
5	1998	4,591	0	4,591	4,156	-435	4,368	3,954	4,158	3,764	-394
6	1999	4,592	0	4,592	4,156	-436	4,326	3,915	4,078	3,690	-387
7	2000	0	346	346	4,156	3,810	323	3,876	301	3,618	3,317
8	2001	0	346	346	3,020	2,674	320	2,789	295	2,578	2,282
9	2002	0	346	346	3,943	3,597	316	3,605	290	3,299	3,010
10	2003	0	346	346	3,950	3,604	313	3,576	284	3,240	2,957
11	2004	0	346	346	3,950	3,604	310	3,540	278	3,177	2,899
12	2005	0	346	346	3,950	3,604	307	3,505	273	3,115	2,842
13	2006	0	346	346	3,950	3,604	304	3,471	267	3,053	2,786
14	2007	0	346	346	3,950	3,604	301	3,436	262	2,994	2,731
15	2008	0	346	346	3,950	3,604	298	3,402	257	2,935	2,678
16	2009	0	346	346	3,950	3,604	295	3,369	252	2,877	2,625
17	2010	0	346	346	3,950	3,604	292	3,335	247	2,821	2,574
18	2011	0	346	346	3,950	3,604	289	3,302	242	2,766	2,523
19	2012	0	346	346	3,950	3,604	286	3,270	238	2,711	2,474
20	2013	0	346	346	3,950	3,604	284	3,237	233	2,658	2,425
21	2014	0	346	346	3,950	3,604	281	3,205	228	2,606	2,378
22	2015	0	346	346	3,950	3,604	278	3,173	224	2,555	2,331
23	2016	0	346	346	3,950	3,604	275	3,142	219	2,505	2,285
24	2017	0	346	346	3,950	3,604	272	3,111	215	2,456	2,241
25	2018	0	346	346	3,950	3,604	270	3,080	211	2,408	2,197
26	2019	0	346	346	3,950	3,604	267	3,050	207	2,360	2,154
27	2020	0	346	346	3,950	3,604	264	3,019	203	2,314	2,111
28	2021	0	346	346	3,950	3,604	262	2,990	199	2,269	2,070
29	2022	0	346	346	3,950	3,604	259	2,960	195	2,224	2,029
30	2023	0	346	346	3,950	3,604	257	2,931	191	2,181	1,990
Total		85,787	8,304	94,091	109,538	15,447	90,158	93,151	86,602	79,842	-6,760
NVP			1.0%	2,994	2.0%	-6,760					
B/C Ratio			1.0%	1.0	2.0%	0.9					
IRR			1.3%								

Table I-3-28 Economic Cash Flow of Kab Daeng F/S Area

No Year	Cost			Benefit		4.0% of discount			5.0% of discount			(1,000 Bahis)
	Initial	O&M Replacement	Total	Gross	Net	Cost	Benefit	Net benefit	Cost	Benefit	Net benefit	
1 1994	4,633	0	4,633	0	-4,633	4,455	0	-4,455	4,412	0	-4,412	
2 1995	30,132	0	30,132	0	-30,132	27,859	0	-27,859	27,331	0	-27,331	
3 1996	40,070	0	40,070	4,866	-35,204	35,622	4,326	-31,296	34,614	4,203	-30,411	
4 1997	6,394	0	6,394	4,860	-1,534	5,466	4,154	-1,311	5,260	3,998	-1,262	
5 1998	4,729	0	4,729	4,866	137	3,887	3,999	113	3,705	3,813	107	
6 1999	0	284	284	4,866	4,582	224	3,846	3,621	212	3,631	3,419	
7 2000	0	284	284	5,906	5,622	216	4,488	4,272	202	4,197	3,995	
8 2001	0	284	284	5,906	5,622	208	4,315	4,108	192	3,997	3,805	
9 2002	0	284	284	5,906	5,622	200	4,149	3,950	183	3,807	3,624	
10 2003	0	284	284	5,906	5,622	192	3,990	3,798	174	3,626	3,451	
11 2004	0	284	284	5,906	5,622	184	3,836	3,652	166	3,453	3,287	
12 2005	0	284	284	5,906	5,622	177	3,689	3,511	158	3,289	3,131	
13 2006	0	284	284	5,906	5,622	171	3,547	3,376	151	3,132	2,981	
14 2007	0	284	284	5,906	5,622	164	3,411	3,247	143	2,983	2,839	
15 2008	0	284	284	5,906	5,622	158	3,279	3,122	137	2,841	2,704	
16 2009	0	284	284	5,906	5,622	152	3,153	3,002	130	2,706	2,576	
17 2010	0	284	284	5,906	5,622	146	3,032	2,886	124	2,577	2,453	
18 2011	0	284	284	5,906	5,622	140	2,915	2,775	118	2,454	2,336	
19 2012	0	284	284	5,906	5,622	135	2,803	2,668	112	2,337	2,225	
20 2013	0	284	284	5,906	5,622	130	2,695	2,566	107	2,226	2,119	
21 2014	0	284	284	5,906	5,622	125	2,592	2,467	102	2,120	2,018	
22 2015	0	284	284	5,906	5,622	120	2,492	2,372	97	2,019	1,922	
23 2016	0	284	284	5,906	5,622	115	2,396	2,281	92	1,923	1,830	
24 2017	0	284	284	5,906	5,622	111	2,304	2,193	88	1,831	1,743	
25 2018	0	284	284	5,906	5,622	107	2,215	2,109	84	1,744	1,660	
26 2019	0	284	284	5,906	5,622	102	2,130	2,028	80	1,661	1,581	
27 2020	0	284	284	5,906	5,622	98	2,048	1,950	76	1,582	1,506	
28 2021	0	284	284	5,906	5,622	95	1,970	1,875	72	1,507	1,434	
29 2022	0	284	284	5,906	5,622	91	1,894	1,803	69	1,435	1,366	
30 2023	0	284	284	5,906	5,622	88	1,821	1,733	66	1,367	1,301	
Total	85,958	7,100	93,058	161,202	68,144	80,935	87,492	6,557	78,459	76,458	-2,001	
NVP		4.0%	6,557		-2,001							
B/C Ratio		4.0%	1.1		1.0							
IRR		4.7%										

Table I-3-29 Economic Cash Flow of Muno Koknai F/S Area

No	Year	Cost		Benefit		5.0% of discount		6.0% of discount		(1,000Bahts)		
		Initial	O&M Replacement	Total	Gross	Net	Cost	Benefit	Net benefit		Cost	Benefit
1	1994	6,461	0	6,461	0	-6,461	6,153	0	-6,153	6,095	0	-6,095
2	1995	37,289	0	37,289	0	-37,289	33,822	0	-33,822	33,187	0	-33,187
3	1996	48,190	0	48,190	4,537	-43,653	41,628	3,919	-37,709	40,461	3,809	-36,652
4	1997	23,879	0	23,879	6,699	-17,180	19,645	5,511	-14,134	18,914	5,306	-13,608
5	1998	4,608	0	4,608	6,699	2,091	3,610	5,249	1,638	3,443	5,006	1,563
6	1999	4,608	0	4,608	6,699	2,091	3,439	4,999	1,560	3,248	4,723	1,474
7	2000	0	346	346	9,089	8,743	246	6,459	6,213	230	6,045	5,815
8	2001	0	346	346	9,391	9,045	234	6,356	6,122	217	5,892	5,675
9	2002	0	346	346	9,391	9,045	223	6,054	5,830	205	5,559	5,354
10	2003	0	346	346	9,391	9,045	212	5,765	5,553	193	5,244	5,051
11	2004	0	346	346	9,391	9,045	202	5,491	5,288	182	4,947	4,765
12	2005	0	346	346	9,391	9,045	193	5,229	5,037	172	4,667	4,495
13	2006	0	346	346	9,391	9,045	183	4,980	4,797	162	4,403	4,241
14	2007	0	346	346	9,391	9,045	175	4,743	4,568	153	4,154	4,001
15	2008	0	346	346	9,391	9,045	166	4,517	4,351	144	3,919	3,774
16	2009	0	346	346	9,391	9,045	159	4,302	4,144	136	3,697	3,561
17	2010	0	346	346	9,391	9,045	151	4,097	3,946	128	3,487	3,359
18	2011	0	346	346	9,391	9,045	144	3,902	3,758	121	3,290	3,169
19	2012	0	346	346	9,391	9,045	137	3,716	3,579	114	3,104	2,989
20	2013	0	346	346	9,391	9,045	130	3,539	3,409	108	2,928	2,820
21	2014	0	346	346	9,391	9,045	124	3,371	3,247	102	2,762	2,661
22	2015	0	346	346	9,391	9,045	118	3,210	3,092	96	2,606	2,510
23	2016	0	346	346	9,391	9,045	113	3,057	2,945	91	2,459	2,368
24	2017	0	346	346	9,391	9,045	107	2,912	2,805	85	2,319	2,234
25	2018	0	346	346	9,391	9,045	102	2,773	2,671	81	2,188	2,107
26	2019	0	346	346	9,391	9,045	97	2,641	2,544	76	2,064	1,988
27	2020	0	346	346	9,391	9,045	93	2,515	2,423	72	1,947	1,876
28	2021	0	346	346	9,391	9,045	88	2,396	2,307	68	1,837	1,769
29	2022	0	346	346	9,391	9,045	84	2,282	2,197	64	1,733	1,669
30	2023	0	346	346	9,391	9,045	80	2,173	2,093	60	1,635	1,575
Total		125,035	8,304	133,339	249,716	116,377	111,861	116,160	4,300	108,411	101,730	-6,681
NVP			5.0%	4,300	6.0%	-6,681						
B/C Ratio			5.0%	1.0	6.0%	0.9						
IRR			5.4%									

Table I-3-30 Economic Cash Flow of Bacho Development Type

No Year	Cost		Benefit		6.0% of discount		7.0% of discount		(1,000 Bahts)		
	Initial	O&M Replacement	Total	Gross	Net	Cost	Benefit	Net benefit		Cost	Benefit
1 1994	5,365	0	5,365	0	-5,365	5,061	0	-5,061	5,014	0	-5,014
2 1995	65,088	0	65,088	0	-65,088	57,928	0	-57,928	56,850	0	-56,850
3 1996	172,401	0	172,401	34,522	-137,879	144,751	28,985	-115,766	140,731	28,180	-112,550
4 1997	119,548	0	119,548	47,810	-71,738	94,693	37,870	-56,823	91,203	36,474	-54,729
5 1998	119,279	0	119,279	47,810	-71,469	89,132	35,726	-53,406	85,044	34,088	-50,956
6 1999	118,744	0	118,744	47,810	-70,934	83,710	33,704	-50,006	79,124	31,858	-47,266
7 2000	0	3,974	3,974	47,810	43,836	2,643	31,796	29,153	2,475	29,774	27,299
8 2001	0	3,974	3,974	34,737	30,763	2,493	21,794	19,301	2,313	20,217	17,904
9 2002	0	3,974	3,974	45,368	41,394	2,352	26,853	24,501	2,162	24,677	22,516
10 2003	0	3,974	3,974	45,447	41,473	2,219	25,377	23,158	2,020	23,103	21,083
11 2004	0	3,974	3,974	45,447	41,473	2,093	23,941	21,847	1,888	21,592	19,704
12 2005	0	3,974	3,974	45,447	41,473	1,975	22,586	20,611	1,765	20,179	18,415
13 2006	0	3,974	3,974	45,447	41,473	1,863	21,307	19,444	1,649	18,859	17,210
14 2007	0	3,974	3,974	45,447	41,473	1,758	20,101	18,344	1,541	17,625	16,084
15 2008	0	3,974	3,974	45,447	41,473	1,658	18,963	17,305	1,440	16,472	15,032
16 2009	0	3,974	3,974	45,447	41,473	1,564	17,890	16,326	1,346	15,394	14,048
17 2010	0	3,974	3,974	45,447	41,473	1,476	16,877	15,402	1,258	14,387	13,129
18 2011	0	3,974	3,974	45,447	41,473	1,392	15,922	14,530	1,176	13,446	12,270
19 2012	0	3,974	3,974	45,447	41,473	1,313	15,021	13,707	1,099	12,566	11,468
20 2013	0	3,974	3,974	45,447	41,473	1,239	14,171	12,931	1,027	11,744	10,717
21 2014	0	3,974	3,974	45,447	41,473	1,169	13,368	12,200	960	10,976	10,016
22 2015	0	3,974	3,974	45,447	41,473	1,103	12,612	11,509	897	10,258	9,361
23 2016	0	3,974	3,974	45,447	41,473	1,040	11,898	10,858	838	9,587	8,749
24 2017	0	3,974	3,974	45,447	41,473	981	11,224	10,243	783	8,960	8,176
25 2018	0	3,974	3,974	45,447	41,473	926	10,589	9,663	732	8,374	7,641
26 2019	0	3,974	3,974	45,447	41,473	874	9,990	9,116	684	7,826	7,141
27 2020	0	3,974	3,974	45,447	41,473	824	9,424	8,600	640	7,314	6,674
28 2021	0	3,974	3,974	45,447	41,473	777	8,891	8,113	598	6,835	6,238
29 2022	0	3,974	3,974	45,447	41,473	733	8,388	7,654	559	6,388	5,830
30 2023	0	3,974	3,974	45,447	41,473	692	7,913	7,221	522	5,970	5,448
Total	600,425	95,376	695,801	1,260,254	564,453	510,436	533,184	22,748	488,337	473,124	-15,213
NVP			22,748								
B/C Ratio			1.0								
IRR			6.0%								

B/C Ratio = 1.0
IRR = 6.6%

Table I-3-31 Economic Cash Flow for Kab Daeng Development Type

No Year	Cost		Benefit			4.0% of discount			5.0% of discount			(1,000 Bahts)
	Initial	O&M Replacement	Total	Gross	Net	Cost	Benefit	Net benefit	Cost	Benefit	Net benefit	
1 1994	12,912	0	12,912	0	-12,912	12,415	0	-12,415	12,297	0	-12,297	
2 1995	28,095	0	28,095	0	-28,095	25,975	0	-25,975	25,483	0	-25,483	
3 1996	74,451	0	74,451	20,438	-54,013	66,187	18,169	-48,017	64,314	17,655	-46,658	
4 1997	51,617	0	51,617	20,414	-31,203	44,122	17,450	-26,672	42,465	16,795	-25,671	
5 1998	51,501	0	51,501	20,438	-31,063	42,330	16,799	-25,532	40,352	16,014	-24,339	
6 1999	51,270	0	51,270	20,438	-30,832	40,519	16,152	-24,367	38,258	15,251	-23,007	
7 2000	0	1,192	1,192	24,807	23,615	906	18,851	17,945	847	17,630	16,783	
8 2001	0	1,192	1,192	24,807	23,615	871	18,126	17,255	807	16,790	15,984	
9 2002	0	1,192	1,192	24,807	23,615	837	17,429	16,592	768	15,991	15,222	
10 2003	0	1,192	1,192	24,807	23,615	805	16,759	15,953	732	15,229	14,498	
11 2004	0	1,192	1,192	24,807	23,615	774	16,114	15,340	697	14,504	13,807	
12 2005	0	1,192	1,192	24,807	23,615	745	15,494	14,750	664	13,813	13,150	
13 2006	0	1,192	1,192	24,807	23,615	716	14,898	14,183	632	13,156	12,524	
14 2007	0	1,192	1,192	24,807	23,615	688	14,325	13,637	602	12,529	11,927	
15 2008	0	1,192	1,192	24,807	23,615	662	13,774	13,113	573	11,933	11,359	
16 2009	0	1,192	1,192	24,807	23,615	636	13,245	12,608	546	11,364	10,818	
17 2010	0	1,192	1,192	24,807	23,615	612	12,735	12,123	520	10,823	10,303	
18 2011	0	1,192	1,192	24,807	23,615	588	12,245	11,657	495	10,308	9,813	
19 2012	0	1,192	1,192	24,807	23,615	566	11,774	11,209	472	9,817	9,345	
20 2013	0	1,192	1,192	24,807	23,615	544	11,322	10,778	449	9,349	8,900	
21 2014	0	1,192	1,192	24,807	23,615	523	10,886	10,363	428	8,904	8,476	
22 2015	0	1,192	1,192	24,807	23,615	503	10,467	9,964	407	8,480	8,073	
23 2016	0	1,192	1,192	24,807	23,615	484	10,065	9,581	388	8,076	7,688	
24 2017	0	1,192	1,192	24,807	23,615	465	9,678	9,213	370	7,692	7,322	
25 2018	0	1,192	1,192	24,807	23,615	447	9,306	8,858	352	7,326	6,974	
26 2019	0	1,192	1,192	24,807	23,615	430	8,948	8,518	335	6,977	6,641	
27 2020	0	1,192	1,192	24,807	23,615	413	8,603	8,190	319	6,645	6,325	
28 2021	0	1,192	1,192	24,807	23,615	398	8,273	7,875	304	6,328	6,024	
29 2022	0	1,192	1,192	24,807	23,615	382	7,954	7,572	290	6,027	5,737	
30 2023	0	1,192	1,192	24,807	23,615	368	7,648	7,281	276	5,740	5,464	
Total	269,846	28,608	298,454	677,096	378,642	245,913	367,492	121,579	235,444	321,146	85,703	
NVP			121,579	85,703								
B/C Ratio		4.0%	1.5	1.4								
IRR		8.9%										

Table I-3-32 Economic Cash Flow of Muno Kokunai Development Type

No	Year	Cost		Benefit		9.0% of discount		10.0% of discount		(1,000 Bahts)		
		Initial	O&M Replacement	Total	Gross	Net	Cost	Benefit	Net benefit		Cost	Benefit
1	1994	9,102	0	9,102	0	-9,102	8,350	0	-8,350	8,275	0	-8,275
2	1995	19,765	0	19,765	0	-19,765	16,636	0	-16,636	16,335	0	-16,335
3	1996	52,366	0	52,366	9,307	-43,059	40,436	7,187	-33,249	39,343	6,992	-32,351
4	1997	36,309	0	36,309	13,631	-22,678	25,722	9,657	-16,066	24,800	9,310	-15,489
5	1998	36,228	0	36,228	13,631	-22,597	23,546	8,859	-14,686	22,495	8,464	-14,031
6	1999	36,065	0	36,065	13,631	-22,434	21,504	8,128	-13,377	20,358	7,694	-12,663
7	2000	0	691	691	19,107	18,416	378	10,452	10,074	355	9,805	9,450
8	2001	0	691	691	19,711	19,020	347	9,892	9,545	322	9,195	8,873
9	2002	0	691	691	19,711	19,020	318	9,075	8,757	293	8,359	8,066
10	2003	0	691	691	19,711	19,020	292	8,326	8,034	266	7,599	7,333
11	2004	0	691	691	19,711	19,020	268	7,639	7,371	242	6,909	6,666
12	2005	0	691	691	19,711	19,020	246	7,008	6,762	220	6,281	6,060
13	2006	0	691	691	19,711	19,020	225	6,429	6,204	200	5,710	5,509
14	2007	0	691	691	19,711	19,020	207	5,898	5,692	182	5,191	5,009
15	2008	0	691	691	19,711	19,020	190	5,411	5,222	165	4,719	4,553
16	2009	0	691	691	19,711	19,020	174	4,965	4,791	150	4,290	4,139
17	2010	0	691	691	19,711	19,020	160	4,555	4,395	137	3,900	3,763
18	2011	0	691	691	19,711	19,020	146	4,179	4,032	124	3,545	3,421
19	2012	0	691	691	19,711	19,020	134	3,834	3,699	113	3,223	3,110
20	2013	0	691	691	19,711	19,020	123	3,517	3,394	103	2,930	2,827
21	2014	0	691	691	19,711	19,020	113	3,227	3,114	93	2,664	2,570
22	2015	0	691	691	19,711	19,020	104	2,960	2,856	85	2,421	2,337
23	2016	0	691	691	19,711	19,020	95	2,716	2,621	77	2,201	2,124
24	2017	0	691	691	19,711	19,020	87	2,492	2,404	70	2,001	1,931
25	2018	0	691	691	19,711	19,020	80	2,286	2,206	64	1,819	1,755
26	2019	0	691	691	19,711	19,020	74	2,097	2,024	58	1,654	1,596
27	2020	0	691	691	19,711	19,020	67	1,924	1,857	53	1,504	1,451
28	2021	0	691	691	19,711	19,020	62	1,765	1,703	48	1,367	1,319
29	2022	0	691	691	19,711	19,020	57	1,619	1,563	44	1,243	1,199
30	2023	0	691	691	19,711	19,020	52	1,486	1,434	40	1,130	1,090
Total		189,835	16,584	206,419	522,660	316,241	140,194	147,582	7,388	135,109	132,118	-2,991
NVP			9.0%	7,388	10.0%	-2,991						
B/C Ratio			9.0%	1.1	10.0%	1.0						
IRR			9.7%									

Table I-3-33 Farm Budget Analysis(1/3)

Bachon F/S arca

Items/project year	Items/project year			
	1	2	3	4
1. Expense				
1-1 Loan Interest	0	2,550	1,700	850
1-2 Loan Repayment	0	7,084	7,084	7,084
1-3 Household expense	30,925	30,925	30,925	30,925
Sub Total	30,925	40,559	39,709	38,859
2. Income				
2-1 Farm Net Income	26,830	30,512	32,069	32,069
2-2 Loan	21,251	0	0	0
2-3 Non Farm Income	16,654	16,654	16,654	16,654
Sub Total	64,735	47,166	48,723	48,723
3. Farm Economic Surplus	33,810	6,607	9,014	9,864

Note:

1) Loan condition is set up as the following;

Interest :12 % per year

Loan repayment period :3years

2) Household expense is assumed to be same with present condition.

3) Non farm income is assumed to be a half of present condition.

Table I-3-33 Farm Budget Analysis(2/3)

Kab Daeng F/S arca

Items/project year	Items/project year			
	1	2	3	4
1. Expense				
1-1 Loan Interest	0	2,162	1,442	721
1-2 Loan Repayment	0	6,007	6,007	6,007
1-3 Household expense	29,071	29,071	29,071	29,071
Sub Total	29,071	37,240	36,519	35,798
2. Income				
2-1 Farm Net Income	35,676	35,676	35,676	35,676
2-2 Loan	18,020	0	0	0
2-3 Non Farm Income	17,980	17,980	17,980	17,980
Sub Total	71,676	53,656	53,656	53,656
3. Farm Economic Surplus	42,605	16,416	17,137	17,858

Note:

1) Loan condition is set up as the following;

Interest :12 % per year

Loan repayment period :3years

2) Household expense is assumed to be same with present condition.

3) Non farm income is assumed to be a half of present condition.

Table I-3-33 Farm Budget Analysis(3/3)

Muno Koknai F/S arca

Items/project year	Items/project year			
	1	2	3	4
1. Expense				
1-1 Loan Interest	0	3,137	2,092	1,046
1-2 Loan Repayment	0	8,715	8,715	8,715
1-3 Household expense	29,751	29,751	29,751	29,751
Sub Total	29,751	41,603	40,558	39,512
2. Income				
2-1 Farm Net Income	23,466	35,805	37,296	37,296
2-2 Loan	26,145	0	0	0
2-3 Non Farm Income	11,096	11,096	11,096	11,096
Sub Total	60,707	46,901	48,392	48,392
3. Farm Economic Surplus	30,956	5,298	7,834	8,880

Note:

1) Loan condition is set up as the following;

Interest :12 % per year

Loan repayment period :3years

2) Household expense is assumed to be same with present condition

3) Non farm income is assumed to be a half of present condition.

Table 1-3-34 Farm Income Sheet for Model Farm - Bacho(1/7)

	1st year		
	Arca Requirement	Loan	Value
Farm Income			
1.Paddy(W)	11.5	617	7,096
2.Paddy(D)	0.0	0	0
3.Coconut	0.0	0	0
4.Baby corn	1.0	473	7,355
5.Long bean	1.0	383	2,247
6.Chilli	1.0	363	7,723
7.Oil Palm	0.0	0	0
8.Pinapple	1.2	2,610	3,132
9.Forage	1.2	0	155
10.Fish	0.20	40,500	8,100
11.Sub Total		19,547	26,830
Non Farm Income			16,654
Total			43,484

Table 1-3-35 Farm Income Sheet for Model Farm - Kab Daeng(1/7)

	1st year		
	Arca Requirement	Loan	Value
Farm Income			
1.Paddy(W)	11.0	617	6,787
2.Paddy(D)	3.3	617	2,036
3.Coconut	0.0	0	0
4.Baby corn	0.9	473	7,355
5.Long bean	0.9	383	2,247
6.Chilli	0.9	363	7,723
7.Oil Palm	0.0	0	0
8.Pinapple	0.0	0	0
9.Forage	0.0	0	0
10.Fish	0.20	40,500	8,100
11.Sub Total		18,020	35,676
Non Farm Income			17,980
Total			53,656

Table 1-3-36 Farm Income Sheet for Model Farm - Muno Koknai(1/7)

	1st year		
	Arca Requirement	Loan	Value
Farm Income			
1.Paddy(W)	10.0	617	6,170
2.Paddy(D)	3.0	617	1,851
3.Coconut	6.0	264	1,584
4.Baby corn	0.5	473	237
5.Long bean	0.5	383	192
6.Chilli	0.5	363	182
7.Oil Palm	0.0	0	0
8.Pinapple	3.0	2,610	7,830
9.Forage	3.0	0	0
10.Fish	0.20	40,500	8,100
11.Sub Total		26,145	23,466
Non Farm Income			11,096
Total			34,562

Table 1-3-34 Farm Income Sheet for Model Farm - Bacho(2/7)

	1st year			2nd year		
	Arca Requirement	Loan	Value	Arca Requirement	Loan	Value
Farm Income						
1.Paddy(W)	11.5	0	0	581	100	6,682
2.Paddy(D)	0.0	0	0	0	0	0
3.Coconut	0.0	0	0	0	0	0
4.Baby corn	1.0	0	7,355	100	7,355	7,355
5.Long bean	1.0	0	2,247	100	2,247	2,247
6.Chilli	1.0	0	7,723	100	7,723	7,723
7.Oil Palm	0.0	0	0	0	0	0
8.Pinapple	1.2	0	3,969	100	4,763	4,763
9.Forage	1.2	0	155	100	186	186
10.Fish	0.20	0	7,785	100	1,557	1,557
11.Sub Total			30,512			30,512
Non Farm Income			16,654			16,654
Total			47,166			47,166

Table 1-3-35 Farm Income Sheet for Model Farm - Kab Daeng(2/7)

	1st year			2nd year		
	Arca Requirement	Loan	Value	Arca Requirement	Loan	Value
Farm Income						
1.Paddy(W)	11.0	0	0	581	100	6,391
2.Paddy(D)	3.3	0	0	824	100	2,719
3.Coconut	0.0	0	0	0	0	0
4.Baby corn	0.9	0	7,355	150	9,929	9,929
5.Long bean	0.9	0	2,247	150	3,033	3,033
6.Chilli	0.9	0	8,923	150	12,046	12,046
7.Oil Palm	0.0	0	0	0	0	0
8.Pinapple	0.0	0	0	0	0	0
9.Forage	0.0	0	0	0	0	0
10.Fish	0.20	0	7,785	100	1,557	1,557
11.Sub Total			35,676			35,676
Non Farm Income			17,980			17,980
Total			53,656			53,656

Table 1-3-36 Farm Income Sheet for Model Farm - Muno Koknai(2/7)

	1st year			2nd year		
	Arca Requirement	Loan	Value	Arca Requirement	Loan	Value
Farm Income						
1.Paddy(W)	10.0	0	0	581	100	5,810
2.Paddy(D)	3.0	0	0	824	100	2,472
3.Coconut	6.0	0	0	-478	100	-2,868
4.Baby corn	0.5	0	7,835	150	5,876	5,876
5.Long bean	0.5	0	2,807	150	2,105	2,105
6.Chilli	0.5	0	11,323	150	8,492	8,492
7.Oil Palm	0.0	0	0	0	0	0
8.Pinapple	3.0	0	3,965	100	11,895	11,895
9.Forage	3.0	0	155	100	465	465
10.Fish	0.20	0	7,785	100	1,557	1,557
11.Sub Total			35,805			35,805
Non Farm Income			11,096			11,096
Total			46,901			46,901

Table I-3-34 Farm Income Sheet for Model Farm - Bacho(3/7)

Farm Income	3rd year		
	Area Requirement	Loan	Value
1.Paddy(W)	11.5	0	581 100 6,682
2.Paddy(D)	0.0	0	0 0 0
3.Coconut	0.0	0	0 0 0
4.Baby corn	1.0	0	7,355 100 7,355
5.Long bean	1.0	0	2,247 100 2,247
6.Chilli	1.0	0	7,723 100 7,723
7.Oil Palm	0.0	0	0 0 0
8.Pinapple	1.2	0	3,969 100 4,763
9.Forage	1.2	0	155 100 186
10.Fish	0.20	0	7,785 200 3,114
11.Sub Total			32,069
Non Farm Income			16,654
Total			48,723

Table I-3-35 Farm Income Sheet for Model Farm - Kab Daeng(3/7)

Farm Income	3rd year		
	Area Requirement	Loan	Value
1.Paddy(W)	11.0	0	581 100 6,391
2.Paddy(D)	3.3	0	824 100 2,719
3.Coconut	0.0	0	0 0 0
4.Baby corn	0.9	0	7,355 150 9,929
5.Long bean	0.9	0	2,247 150 3,033
6.Chilli	0.9	0	8,923 150 12,046
7.Oil Palm	0.0	0	0 0 0
8.Pinapple	0.0	0	0 0 0
9.Forage	0.0	0	0 0 0
10.Fish	0.20	0	7,785 200 3,114
11.Sub Total			37,233
Non Farm Income			17,980
Total			55,213

Table I-3-36 Farm Income Sheet for Model Farm - Muno Koknai(3/7)

Farm Income	3rd year		
	Area Requirement	Loan	Value
1.Paddy(W)	10.0	0	581 100 5,810
2.Paddy(D)	3.0	0	824 100 2,472
3.Coconut	6.0	0	-470 100 -2,820
4.Baby corn	0.5	0	7,835 150 5,876
5.Long bean	0.5	0	2,807 150 2,105
6.Chilli	0.5	0	11,323 150 8,492
7.Oil Palm	0.0	0	0 0 0
8.Pinapple	3.0	0	3,965 100 11,895
9.Forage	3.0	0	155 100 465
10.Fish	0.20	0	7,785 200 3,114
11.Sub Total			37,410
Non Farm Income			11,096
Total			48,506

Table I-3-34 Farm Income Sheet for Model Farm - Bacho(4/7)

Farm Income	4th year		
	Area Requirement	Loan	Value
1.Paddy(W)	11.5	0	581 100 6,682
2.Paddy(D)	0.0	0	0 0 0
3.Coconut	0.0	0	0 0 0
4.Baby corn	1.0	0	7,355 100 7,355
5.Long bean	1.0	0	2,247 100 2,247
6.Chilli	1.0	0	7,723 100 7,723
7.Oil Palm	0.0	0	0 0 0
8.Pinapple	1.2	0	3,969 100 4,763
9.Forage	1.2	0	155 100 186
10.Fish	0.20	0	7,785 200 3,114
11.Sub Total			32,069
Non Farm Income			16,654
Total			48,723

Table I-3-35 Farm Income Sheet for Model Farm - Kab Daeng(4/7)

Farm Income	4th year		
	Area Requirement	Loan	Value
1.Paddy(W)	11.0	0	581 100 6,391
2.Paddy(D)	3.3	0	824 100 2,719
3.Coconut	0.0	0	0 0 0
4.Baby corn	0.9	0	7,355 150 9,929
5.Long bean	0.9	0	2,247 150 3,033
6.Chilli	0.9	0	8,923 150 12,046
7.Oil Palm	0.0	0	0 0 0
8.Pinapple	0.0	0	0 0 0
9.Forage	0.0	0	0 0 0
10.Fish	0.20	0	7,785 200 3,114
11.Sub Total			37,233
Non Farm Income			17,980
Total			55,213

Table I-3-36 Farm Income Sheet for Model Farm - Muno Koknai(4/7)

Farm Income	4th year		
	Area Requirement	Loan	Value
1.Paddy(W)	10.0	0	581 100 5,810
2.Paddy(D)	3.0	0	824 100 2,472
3.Coconut	6.0	0	-470 100 -2,820
4.Baby corn	0.5	0	7,835 150 5,876
5.Long bean	0.5	0	2,807 150 2,105
6.Chilli	0.5	0	11,323 150 8,492
7.Oil Palm	0.0	0	0 0 0
8.Pinapple	3.0	0	3,965 100 11,895
9.Forage	3.0	0	155 100 465
10.Fish	0.20	0	7,785 200 3,114
11.Sub Total			37,410
Non Farm Income			11,096
Total			48,506

Table 1-3-34 Farm Income Sheet for Model Farm - Bacho(5/7)

Farm Income	5th year			5th year		
	Area Requirement	Loan	Value	Area Requirement	Loan	Value
1.Paddy(W)	11.5	0	581 100	0	0	6,682
2.Paddy(D)	0.0	0	0	0	0	0
3.Coconut	0.0	0	0	0	0	0
4.Baby corn	1.0	0	7,355 100	0	0	7,355
5.Long bean	1.0	0	2,247 100	0	0	2,247
6.Chilli	1.0	0	7,723 100	0	0	7,723
7.Oil Palm	0.0	0	0	0	0	0
8.Pinapple	1.2	0	4,122 100	0	0	4,946
9.Forage	1.2	0	155 100	0	0	186
10.Fish	0.20	0	7,785 200	0	0	3,114
11.Sub Total						32,253
Non Farm Income						16,654
Total						48,907

Table 1-3-35 Farm Income Sheet for Model Farm - Kab Daeng(5/7)

Farm Income	5th year			5th year		
	Area Requirement	Loan	Value	Area Requirement	Loan	Value
1.Paddy(W)	11.0	0	965 100	0	0	10,615
2.Paddy(D)	3.3	0	1,100 100	0	0	3,630
3.Coconut	0.0	0	0	0	0	0
4.Baby corn	0.9	0	7,355 150	0	0	9,929
5.Long bean	0.9	0	2,247 150	0	0	3,033
6.Chilli	0.9	0	8,923 150	0	0	12,046
7.Oil Palm	0.0	0	0	0	0	0
8.Pinapple	0.0	0	0	0	0	0
9.Forage	0.0	0	0	0	0	0
10.Fish	0.20	0	7,785 200	0	0	3,114
11.Sub Total						42,368
Non Farm Income						17,980
Total						60,348

Table 1-3-36 Farm Income Sheet for Model Farm - Muno Koknai(5/7)

Farm Income	5th year			5th year		
	Area Requirement	Loan	Value	Area Requirement	Loan	Value
1.Paddy(W)	10.0	0	1,100 100	0	0	11,000
2.Paddy(D)	3.0	0	1,304 100	0	0	3,912
3.Coconut	6.0	0	1,852 100	0	0	11,112
4.Baby corn	0.5	0	7,835 150	0	0	5,876
5.Long bean	0.5	0	2,807 150	0	0	2,105
6.Chilli	0.5	0	11,323 150	0	0	8,492
7.Oil Palm	0.0	0	0	0	0	0
8.Pinapple	3.0	0	4,122 100	0	0	12,366
9.Forage	3.0	0	155 100	0	0	465
10.Fish	0.20	0	7,785 200	0	0	3,114
11.Sub Total						58,443
Non Farm Income						11,096
Total						69,539

Table 1-3-34 Farm Income Sheet for Model Farm - Bacho(6/7)

Farm Income	6th year			6th year		
	Area Requirement	Loan	Value	Area Requirement	Loan	Value
1.Paddy(W)	11.5	0	581 100	0	0	6,682
2.Paddy(D)	0.0	0	0	0	0	0
3.Coconut	0.0	0	0	0	0	0
4.Baby corn	1.0	0	7,355 100	0	0	7,355
5.Long bean	1.0	0	2,247 100	0	0	2,247
6.Chilli	1.0	0	7,723 100	0	0	7,723
7.Oil Palm	0.0	0	0	0	0	0
8.Pinapple	1.2	0	4,122 100	0	0	4,946
9.Forage	1.2	0	155 100	0	0	186
10.Fish	0.20	0	7,785 200	0	0	3,114
11.Sub Total						32,253
Non Farm Income						16,654
Total						48,907

Table 1-3-35 Farm Income Sheet for Model Farm - Kab Daeng(6/7)

Farm Income	6th year			6th year		
	Area Requirement	Loan	Value	Area Requirement	Loan	Value
1.Paddy(W)	11.0	0	965 100	0	0	10,615
2.Paddy(D)	3.3	0	1,100 100	0	0	3,630
3.Coconut	0.0	0	0	0	0	0
4.Baby corn	0.9	0	7,355 150	0	0	9,929
5.Long bean	0.9	0	2,247 150	0	0	3,033
6.Chilli	0.9	0	8,923 150	0	0	12,046
7.Oil Palm	0.0	0	0	0	0	0
8.Pinapple	0.0	0	0	0	0	0
9.Forage	0.0	0	0	0	0	0
10.Fish	0.20	0	7,785 200	0	0	3,114
11.Sub Total						42,368
Non Farm Income						17,980
Total						60,348

Table 1-3-36 Farm Income Sheet for Model Farm - Muno Koknai(6/7)

Farm Income	6th year			6th year		
	Area Requirement	Loan	Value	Area Requirement	Loan	Value
1.Paddy(W)	10.0	0	1,100 100	0	0	11,000
2.Paddy(D)	3.0	0	1,304 100	0	0	3,912
3.Coconut	6.0	0	2,143 100	0	0	12,858
4.Baby corn	0.5	0	7,835 150	0	0	5,876
5.Long bean	0.5	0	2,807 150	0	0	2,105
6.Chilli	0.5	0	11,323 150	0	0	8,492
7.Oil Palm	0.0	0	0	0	0	0
8.Pinapple	3.0	0	4,122 100	0	0	12,366
9.Forage	3.0	0	155 100	0	0	465
10.Fish	0.20	0	7,785 200	0	0	3,114
11.Sub Total						60,189
Non Farm Income						11,096
Total						71,285

Table 1-3-34 Farm Income Sheet for Model Farm - Bacho(7/7)

	7th year		
	Area Requirement	Loan	Value
Farm Income			
1.Paddy(W)	11.5	0	6,682
2.Paddy(D)	0.0	0	0
3.Coconut	0.0	0	0
4.Baby corn	1.0	0	7,355
5.Long bean	1.0	0	2,247
6.Chilli	1.0	0	7,723
7.Oil Palm	0.0	0	0
8.Pinapple	1.2	0	4,946
9.Forage	1.2	0	186
10.Fish	0.20	0	3,114
11.Sub Total			32,253
Non Farm Income			16,654
Total			48,907

Note:

- 1) The cultivating area is set up the above area with considering the land use plan,labor force and actual farming etc.
- 2) Non farm income is assumed to be a half of present condition.
- 3) Family labor force is 2.9 persons of which half is assumed to be mainly engaged in farm activities at least.

Table 1-3-35 Farm Income Sheet for Model Farm - Kab Daeng(7/7)

	7th year		
	Area Requirement	Loan	Value
Farm Income			
1.Paddy(W)	11.0	0	10,615
2.Paddy(D)	3.3	0	3,630
3.Coconut	0.0	0	0
4.Baby corn	0.9	0	7,355
5.Long bean	0.9	0	2,247
6.Chilli	0.9	0	8,923
7.Oil Palm	0.0	0	0
8.Pinapple	0.0	0	0
9.Forage	0.0	0	0
10.Fish	0.20	0	3,114
11.Sub Total			42,368
Non Farm Income			17,980
Total			60,348

Note:

- 1) The cultivating area is set up the above area with considering the land use plan,labor force and actual farming etc.
- 2) Non farm income is assumed to be a half of present condition.
- 3) Family labor force is 2.9 persons of which the half is assumed to be mainly engaged in farm activities at least.
- 4) The crop intensity for vegetables is assumed to be 150%.

Table 1-3-36 Farm Income Sheet for Model Farm - Muno Koknai(7/7)

	7th year		
	Area Requirement	Loan	Value
Farm Income			
1.Paddy(W)	10.0	0	11,000
2.Paddy(D)	3.0	0	3,912
3.Coconut	6.0	0	12,858
4.Baby corn	0.5	0	5,876
5.Long bean	0.5	0	2,105
6.Chilli	0.5	0	8,492
7.Oil Palm	0.0	0	0
8.Pinapple	3.0	0	12,366
9.Forage	3.0	0	465
10.Fish	0.20	0	3,114
11.Sub Total			60,189
Non Farm Income			11,096
Total			71,285

Note:

- 1) The cultivating area is set up the above area with considering the land use plan,labor force and actual farming etc.
- 2) Non farm income is assumed to be a half of present condition.
- 3) Family labor force is 2.9 persons of which the half is assumed to be mainly engaged in farm activities at least.
- 4) The crop intensity for vegetables is assumed to be 150%.

Table I-3-37 Foreign Loan Repayment Schedule (1/4)

Project Calendar Year	Bacho Project				Total Repayment
	Annual F/C Loan Amount	Loan Total	Interest	Principal Repayment	
1 1994	4,367		131		131
2 1995	15,455	19,822	595		595
3 1996	13,483	33,305	999		999
4 1997	9,270	42,575	1,277		1,277
5 1998	4,660	47,235	1,417		1,417
6 1999	4,708	51,943	1,558	51,943	1,558
7 2000				49,346	4,078
8 2001				46,749	4,000
9 2002				44,152	3,922
10 2003				41,554	3,844
11 2004				38,957	3,766
12 2005				36,360	3,688
13 2006				33,763	3,610
14 2007				31,166	3,532
15 2008				28,569	3,454
16 2009				25,971	3,376
17 2010				23,374	3,298
18 2011				20,777	3,220
19 2012				18,180	3,143
20 2013				15,583	3,065
21 2014				12,986	2,987
22 2015				10,389	2,909
23 2016				7,791	2,831
24 2017				5,194	2,753
25 2018				2,597	2,675
26 2019				0	2,597
27 2020				0	0
28 2021				0	0
29 2022				0	0
30 2023				0	0
Total	51,943		5,977	51,943	72,724

Note: Loan interest is assumed to be 3.0% per annum.

Loan repayment will start from 6 th year during 20 years.

Table I-3-38 Annual Budget Requirement (1/4)

Project Calendar Year	Bacho Project				Total Requirement
	L/C Investment	F/C Loan Repayment	O&M Cost	Total Budget Requirement	
1 1994		728	131	0	859
2 1995	12,936	595		0	13,531
3 1996	22,310	999		0	23,309
4 1997	10,004	1,277		0	11,281
5 1998	227	1,417		0	1,644
6 1999	239	1,558		0	1,797
7 2000		4,078		393	4,471
8 2001		4,000		393	4,393
9 2002		3,922		393	4,315
10 2003		3,844		393	4,237
11 2004		3,766		393	4,159
12 2005		3,688		393	4,081
13 2006		3,610		393	4,003
14 2007		3,532		393	3,925
15 2008		3,454		393	3,847
16 2009		3,376		393	3,769
17 2010		3,298		393	3,691
18 2011		3,220		393	3,613
19 2012		3,143		393	3,536
20 2013		3,065		393	3,458
21 2014		2,987		393	3,380
22 2015		2,909		393	3,302
23 2016		2,831		393	3,224
24 2017		2,753		393	3,146
25 2018		2,675		393	3,068
26 2019		2,597		393	2,990
27 2020		0		393	393
28 2021		0		393	393
29 2022		0		393	393
30 2023		0		393	393
Total		72,724	9,432		128,600

Table I-3-37 Foreign Loan Repayment Schedule (2/4)

Project Calendar		Kab Daeng Project					Total	
		Annual F/C	Loan	Interest	Principal Repayment	Interest	Repayment	
Year	Year	Loan Amount	Total					
1	1994	4,151		125			125	
2	1995	16,104	20,255	608			608	
3	1996	18,484	38,739	1,162			1,162	
4	1997	6,556	45,295	1,359			1,359	
5	1998	4,870	50,165	1,505			1,505	
6	1999		0	1,505	50,165		1,505	
7	2000				47,657	2,508	3,938	
8	2001				45,149	2,508	3,863	
9	2002				42,640	2,508	3,787	
10	2003				40,132	2,508	3,712	
11	2004				37,624	2,508	3,637	
12	2005				35,116	2,508	3,562	
13	2006				32,607	2,508	3,486	
14	2007				30,099	2,508	3,411	
15	2008				27,591	2,508	3,336	
16	2009				25,083	2,508	3,261	
17	2010				22,574	2,508	3,185	
18	2011				20,066	2,508	3,110	
19	2012				17,558	2,508	3,035	
20	2013				15,050	2,508	2,960	
21	2014				12,541	2,508	2,884	
22	2015				10,033	2,508	2,809	
23	2016				7,525	2,508	2,734	
24	2017				5,017	2,508	2,659	
25	2018				2,508	2,508	2,583	
26	2019				0	2,508	2,508	
27	2020				0	0	0	
28	2021				0	0	0	
29	2022				0	0	0	
30	2023				0	0	0	
Total		50,165		6,263	50,165	14,297	70,725	

Note; Loan interest is assumed to be 3.0% per annum.

Loan repayment will start from 6 th year during 20 years.

Table I-3-38 Annual Budget Requirement (2/4)

Project Calendar		Kab Daeng Project			Total Budget Requirement	
		L/C	F/C Loan	O&M	Cost	Requirement
Year	Year	Investment	Repayment			
1	1994		125		0	746
2	1995	18,622	608		0	19,230
3	1996	29,112	1,162		0	30,274
4	1997	130	1,359		0	1,489
5	1998	138	1,505		0	1,643
6	1999		1,505	323		1,828
7	2000		3,938	323		4,261
8	2001		3,863	323		4,186
9	2002		3,787	323		4,110
10	2003		3,712	323		4,035
11	2004		3,637	323		3,960
12	2005		3,562	323		3,885
13	2006		3,486	323		3,809
14	2007		3,411	323		3,734
15	2008		3,336	323		3,659
16	2009		3,261	323		3,584
17	2010		3,185	323		3,508
18	2011		3,110	323		3,433
19	2012		3,035	323		3,358
20	2013		2,960	323		3,283
21	2014		2,884	323		3,207
22	2015		2,809	323		3,132
23	2016		2,734	323		3,057
24	2017		2,659	323		2,982
25	2018		2,583	323		2,906
26	2019		0	323		323
27	2020		0	323		323
28	2021		0	323		323
29	2022		0	323		323
30	2023		0	323		323
Total			68,217	8,075		124,915

Table I-3-37 Foreign Loan Repayment Schedule (3/4)

Project Calendar		Muno Koknai Project					Total	
Year	Loan Amount	Annual F/C	Loan	Interest	Principal Repayment	Repayment	Interest	Repayment
1	1994	5,903		177		177		177
2	1995	20,784	26,687	801		801		801
3	1996	20,849	47,536	1,426		1,426		1,426
4	1997	12,726	60,262	1,808		1,808		1,808
5	1998	4,660	64,922	1,948		1,948		1,948
6	1999	4,707	69,629	2,089	69,629	2,089		2,089
7	2000				67,032	2,597	2,011	4,608
8	2001				64,435	2,597	1,933	4,530
9	2002				61,838	2,597	1,855	4,452
10	2003				59,240	2,597	1,777	4,374
11	2004				56,643	2,597	1,699	4,296
12	2005				54,046	2,597	1,621	4,219
13	2006				51,449	2,597	1,543	4,141
14	2007				48,852	2,597	1,466	4,063
15	2008				46,255	2,597	1,388	3,985
16	2009				43,658	2,597	1,310	3,907
17	2010				41,060	2,597	1,232	3,829
18	2011				38,463	2,597	1,154	3,751
19	2012				35,866	2,597	1,076	3,673
20	2013				33,269	2,597	998	3,595
21	2014				30,672	2,597	920	3,517
22	2015				28,075	2,597	842	3,439
23	2016				25,477	2,597	764	3,361
24	2017				22,880	2,597	686	3,284
25	2018				20,283	2,597	608	3,206
26	2019				17,686	2,597	531	3,128
27	2020					0	0	0
28	2021					0	0	0
29	2022					0	0	0
30	2023					0	0	0
Total		69,629		8,248	51,943	25,415		85,607

Note: Loan interest is assumed to be 3.0% per annum.

Loan repayment will start from 6 th year during 20 years.

Table I-3-38 Annual Budget Requirement (3/4)

Project Calendar		Muno Koknai Project					Total	
Year	Year	L/C	Investment	Repayment	O&M	Cost	Requirement	
1	1994		735	177		0	912	
2	1995		21,191	801		0	21,992	
3	1996		36,773	1,426		0	38,199	
4	1997		16,099	1,808		0	17,907	
5	1998		253	1,948		0	2,201	
6	1999		265	2,089		0	2,354	
7	2000			4,608	393		5,001	
8	2001			4,530	393		4,923	
9	2002			4,452	393		4,845	
10	2003			4,374	393		4,767	
11	2004			4,296	393		4,689	
12	2005			4,219	393		4,612	
13	2006			4,141	393		4,534	
14	2007			4,063	393		4,456	
15	2008			3,985	393		4,378	
16	2009			3,907	393		4,300	
17	2010			3,829	393		4,222	
18	2011			3,751	393		4,144	
19	2012			3,673	393		4,066	
20	2013			3,595	393		3,988	
21	2014			3,517	393		3,910	
22	2015			3,439	393		3,832	
23	2016			3,361	393		3,754	
24	2017			3,284	393		3,677	
25	2018			3,206	393		3,599	
26	2019			3,128	393		3,521	
27	2020			0	393		393	
28	2021			0	393		393	
29	2022			0	393		393	
30	2023			0	393		393	
Total				85,607	9,432		170,355	

Table I-3-37 Foreign Loan Repayment Schedule (4/4)

Project Calendar		Annual F/C		Loan		Interest		Principal Repayment		Interest		Total Repayment	
Year		Loan Amount		Total		Total		Total		Total		Total	
1	1994	14,421				433						433	
2	1995	52,343	66,764			2,003						2,003	
3	1996	52,816	119,580			3,587						3,587	
4	1997	28,552	148,132			4,444						4,444	
5	1998	14,190	162,322			4,870						4,870	
6	1999	9,415	171,737			5,152	171,737					3,647	
7	2000				163,150		8,587	4,895				13,481	
8	2001				154,563		8,587	4,637				13,224	
9	2002				145,976		8,587	4,379				12,966	
10	2003				137,390		8,587	4,122				12,709	
11	2004				128,803		8,587	3,864				12,451	
12	2005				120,216		8,587	3,606				12,193	
13	2006				111,629		8,587	3,349				11,936	
14	2007				103,042		8,587	3,091				11,678	
15	2008				94,455		8,587	2,834				11,421	
16	2009				85,868		8,587	2,576				11,163	
17	2010				77,282		8,587	2,318				10,905	
18	2011				68,695		8,587	2,061				10,648	
19	2012				60,108		8,587	1,803				10,390	
20	2013				51,521		8,587	1,546				10,132	
21	2014				42,934		8,587	1,288				9,875	
22	2015				34,347		8,587	1,030				9,617	
23	2016				25,761		8,587	773				9,360	
24	2017				17,174		8,587	515				9,102	
25	2018				8,587		8,587	258				8,844	
26	2019				0		8,587	0				8,587	
27	2020						0	0				0	
28	2021						0	0				0	
29	2022						0	0				0	
30	2023						0	0				0	
Total		171,737				20,489	171,737	48,945				239,666	

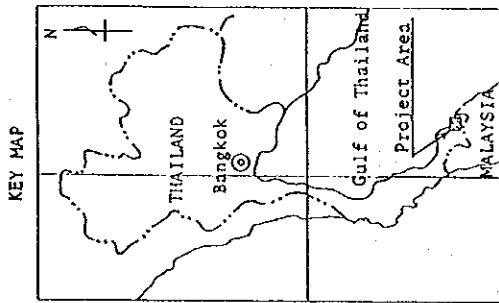
Note: Loan interest is assumed to be 3.0% per annum.

Loan repayment will start from 6 th year during 20 years.

Table I-3-38 Annual Budget Requirement (4/4)

Project Calendar		L/C		F/C Loan		O&M		Total Budget Requirement	
Year		Investment		Repayment		Cost		Requirement	
1	1994		2,084		433		0		2,517
2	1995		52,749		2,003		0		54,752
3	1996		88,195		3,587		0		91,782
4	1997		26,233		4,444		0		30,677
5	1998		618		4,870		0		5,488
6	1999		504		3,647		323		4,474
7	2000				13,481		1,109		14,590
8	2001				13,224		1,109		14,333
9	2002				12,966		1,109		14,075
10	2003				12,709		1,109		13,818
11	2004				12,451		1,109		13,560
12	2005				12,193		1,109		13,302
13	2006				11,936		1,109		13,045
14	2007				11,678		1,109		12,787
15	2008				11,421		1,109		12,530
16	2009				11,163		1,109		12,272
17	2010				10,905		1,109		12,014
18	2011				10,648		1,109		11,757
19	2012				10,390		1,109		11,499
20	2013				10,132		1,109		11,241
21	2014				9,875		1,109		10,984
22	2015				9,617		1,109		10,726
23	2016				9,360		1,109		10,469
24	2017				9,102		1,109		10,211
25	2018				8,844		1,109		9,953
26	2019				8,587		1,109		9,696
27	2020				0		1,109		1,109
28	2021				0		1,109		1,109
29	2022				0		1,109		1,109
30	2023				0		1,109		1,109
Total					239,666		26,939		436,988

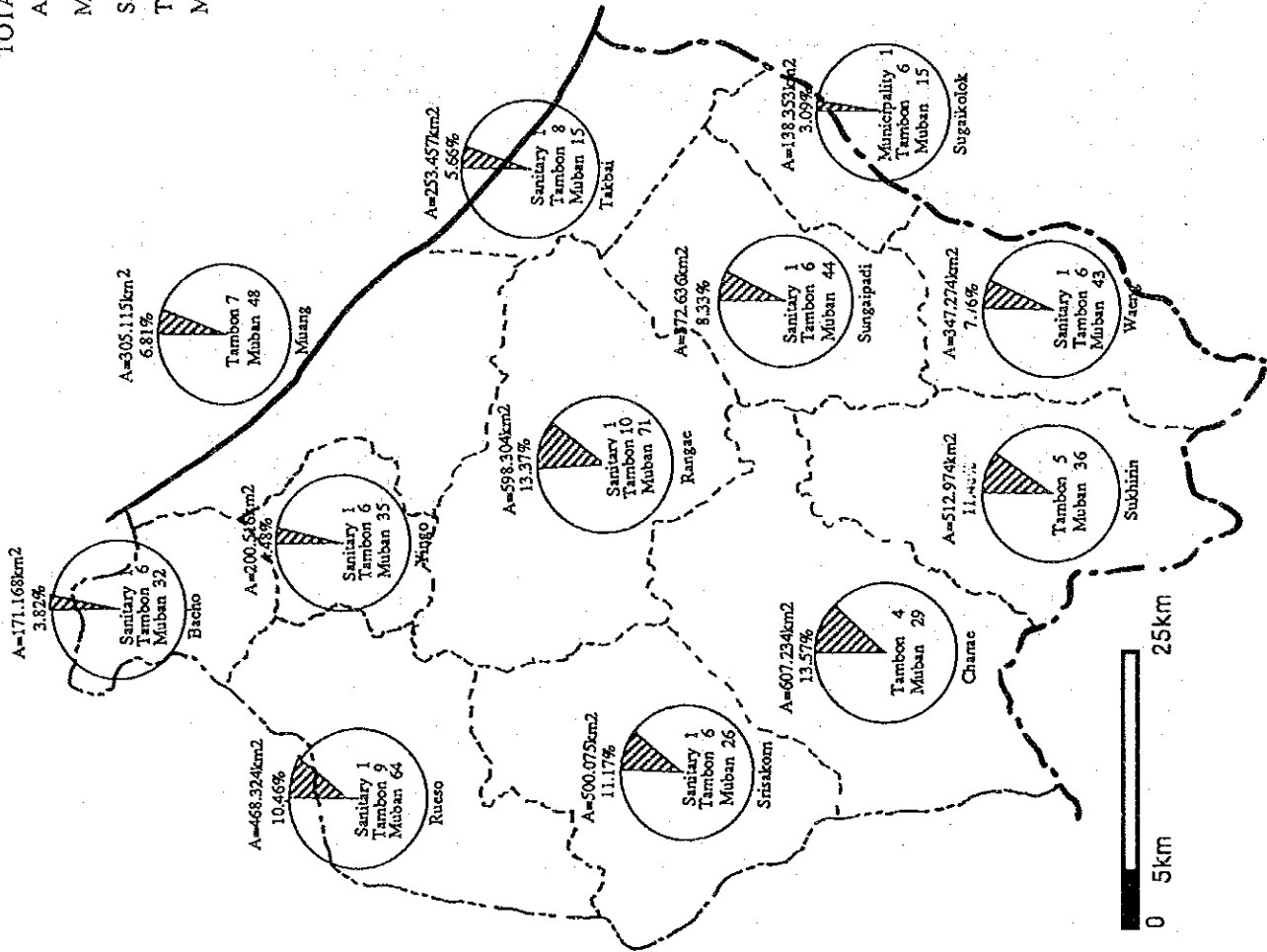
Figure I-1-1
Administration in the Narathiwat Province



TOTAL NUMBER OF NARATHIWAT
Area 4,475.43km²
Municipality 2
Sanitary 8
Tambon 77
Muban 492

SOURCE:

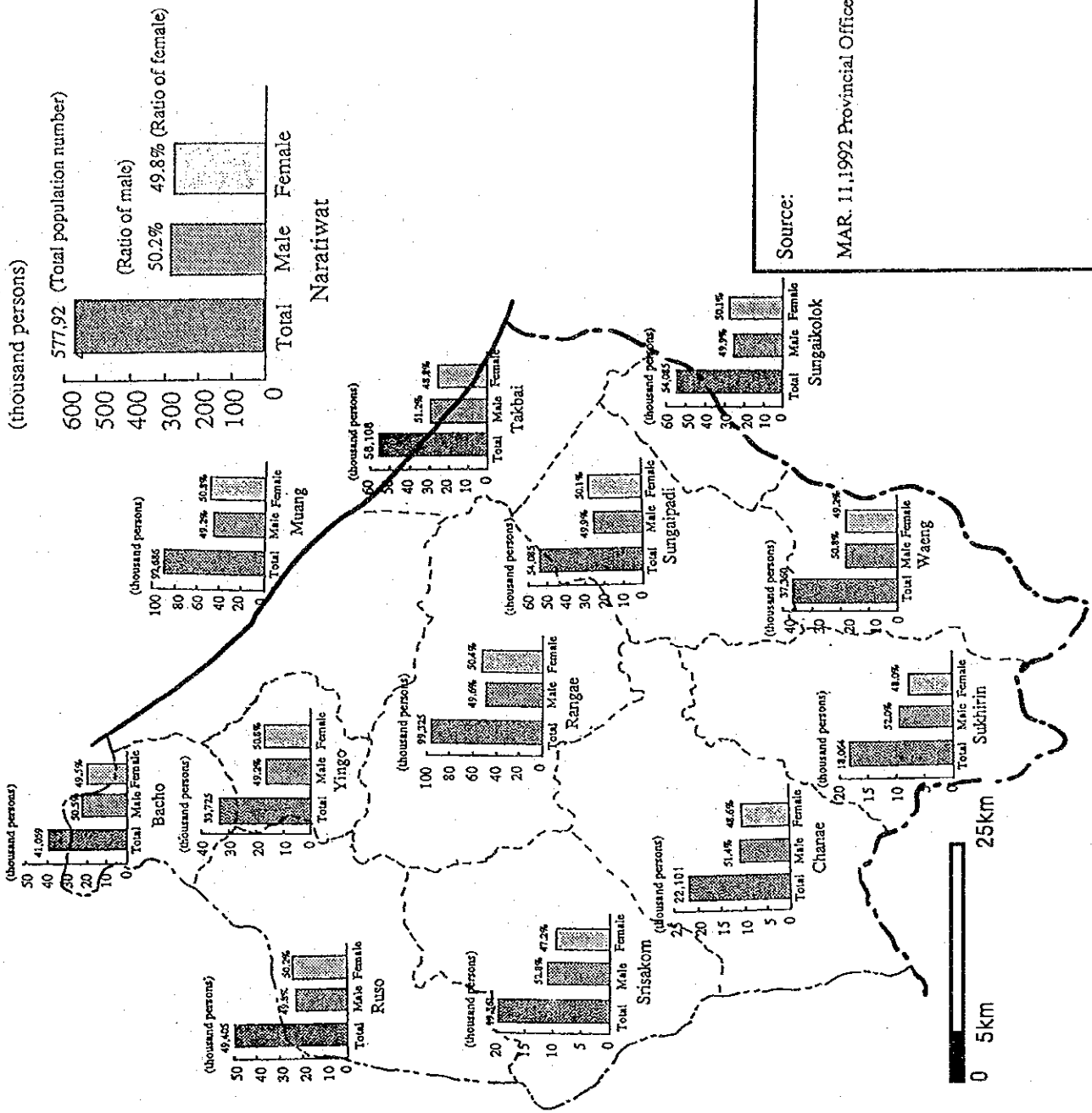
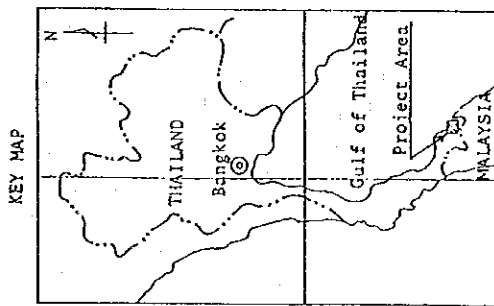
MAR. 11, 1992 Provincial Office



THE STUDY ON THE AGRICULTURAL DEVELOPMENT
FOR PEAT/ACID SULFATE SOIL AREAS
IN NARATHIWAT PROVINCE

JAPAN INTERNATIONAL COOPERATION AGENCY

Figure I-1-2
District Basis Population of
the Narathiwat Province



THE STUDY ON THE AGRICULTURAL DEVELOPMENT
FOR PEAT/ACID SULFATE SOIL AREAS
IN NARATHIWAT PROVINCE

JAPAN INTERNATIONAL COOPERATION AGENCY

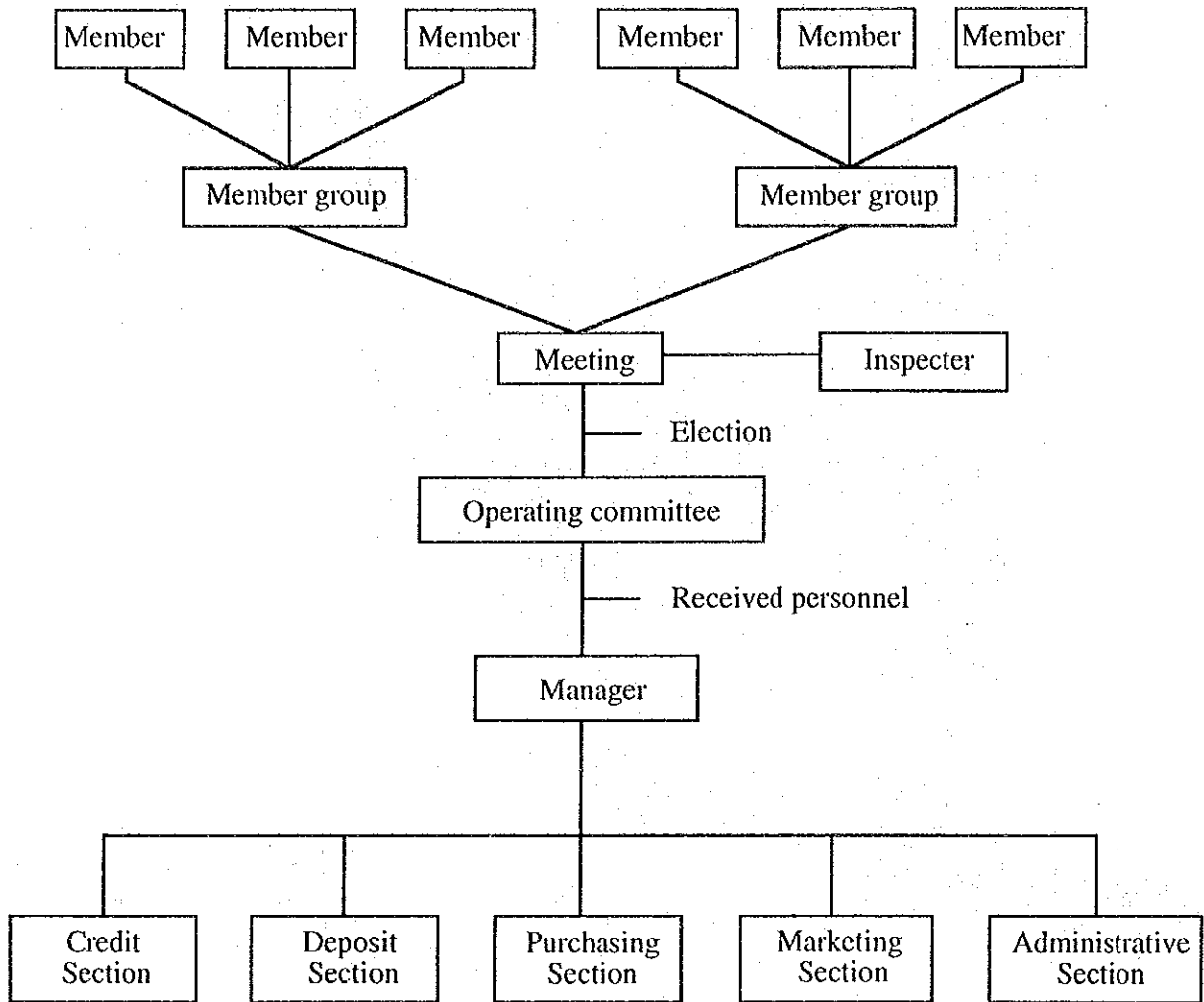


Figure I-1-3 Structure of Producer's Cooperative(Agriculture, Settlement, Fisher)

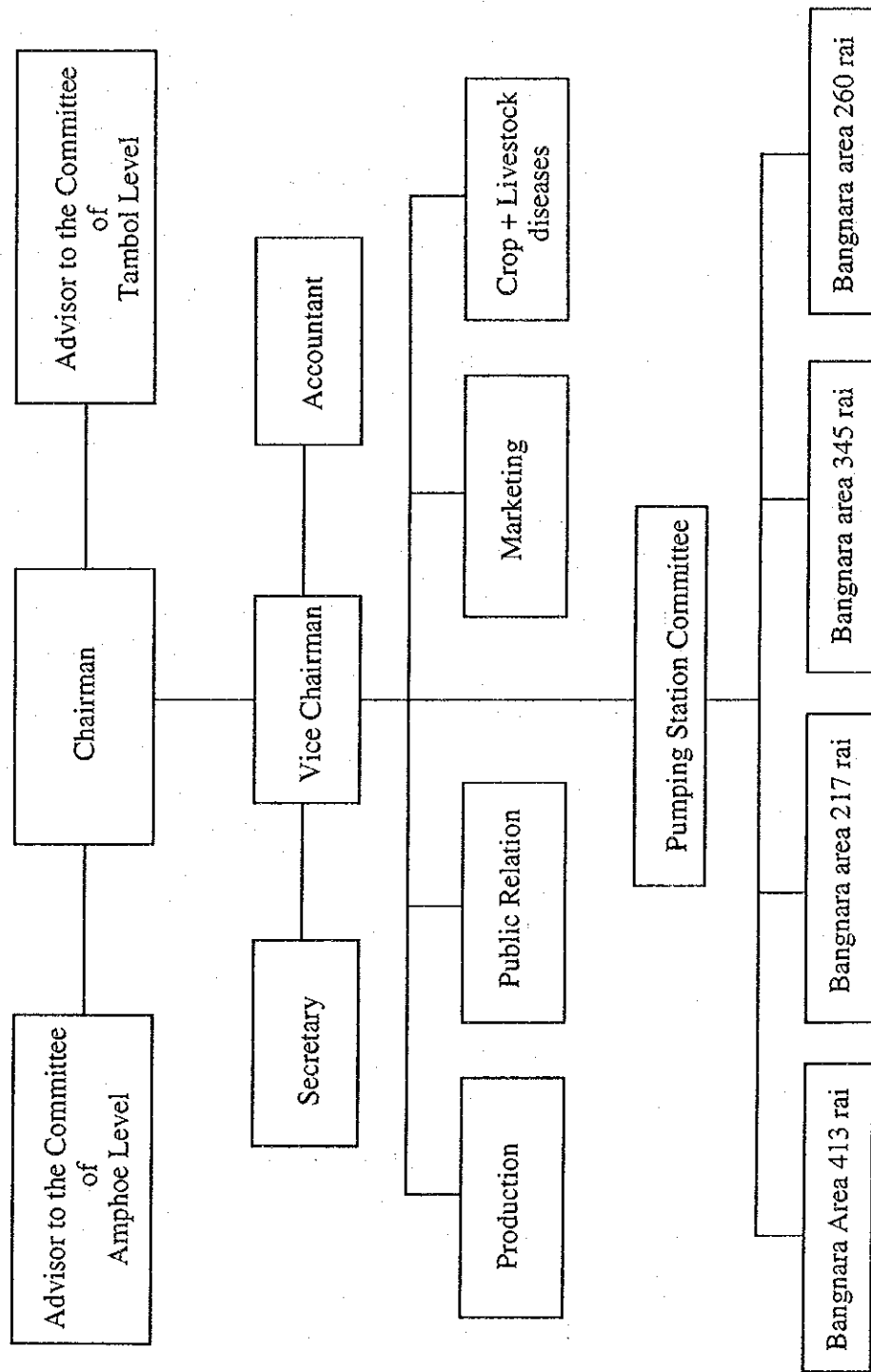


Figure I-1-4 Organization Chart of the Mixed Farming Development Group Committee of Bangnara Basin, Tambol Level
 Ban Ple, Village 3, Tambol Kahawo Nua, Amphoe Muang

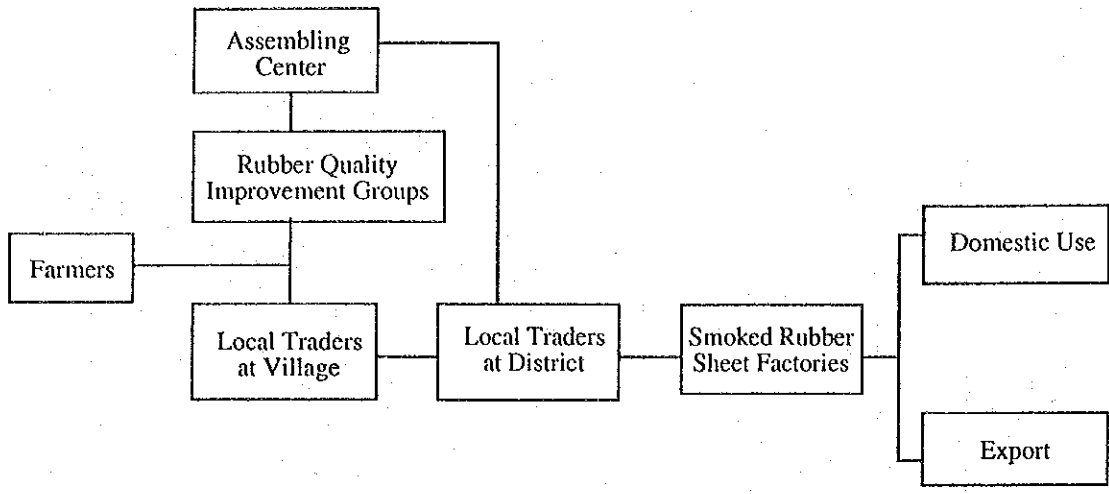


Figure I-1-5 Marketing Flow of Para Rubber

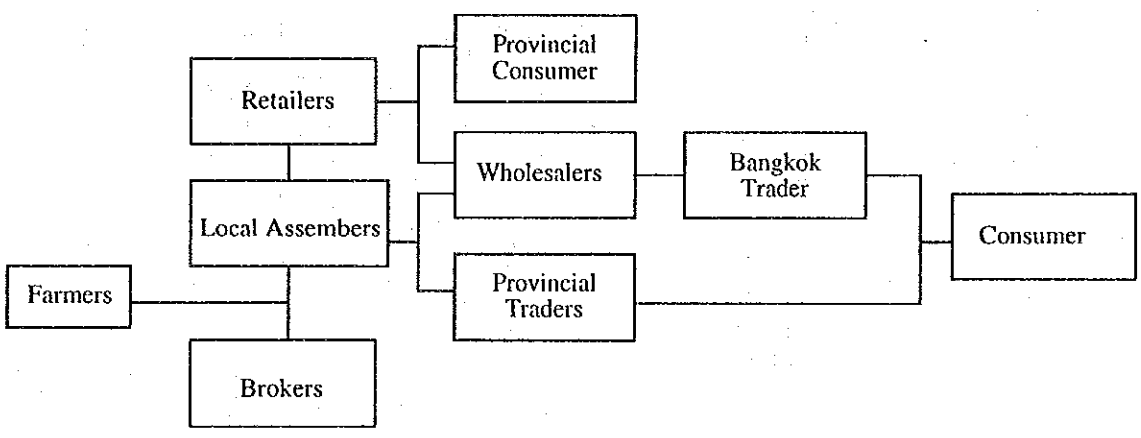


Figure I-1-6 Marketing Flow of Longkong

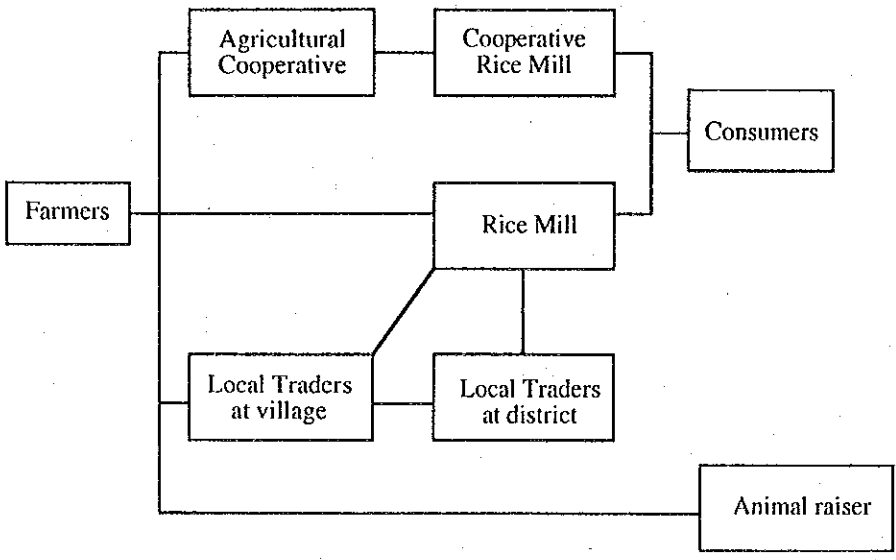
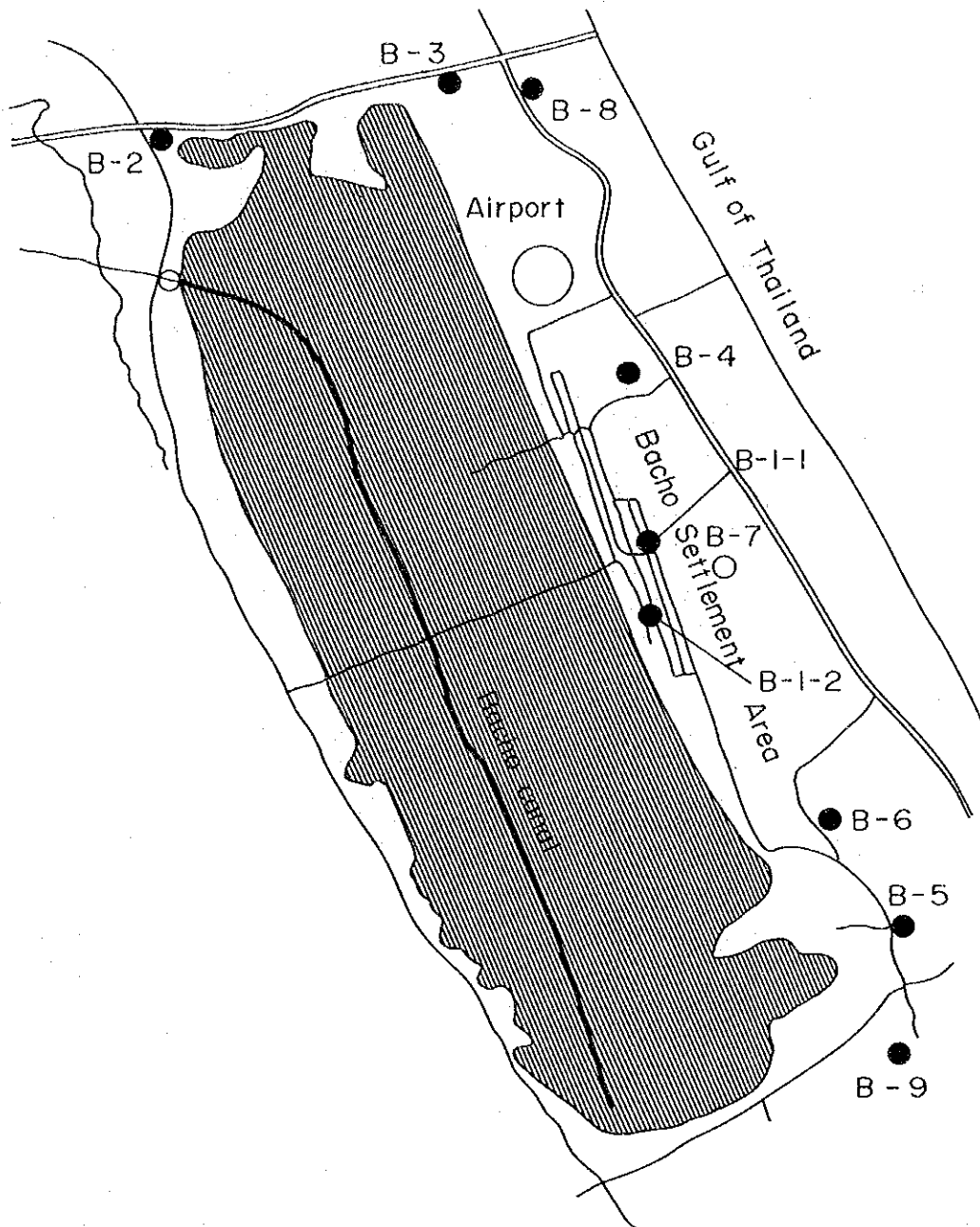






Figure I-1-7 Marketing Flow of Rice

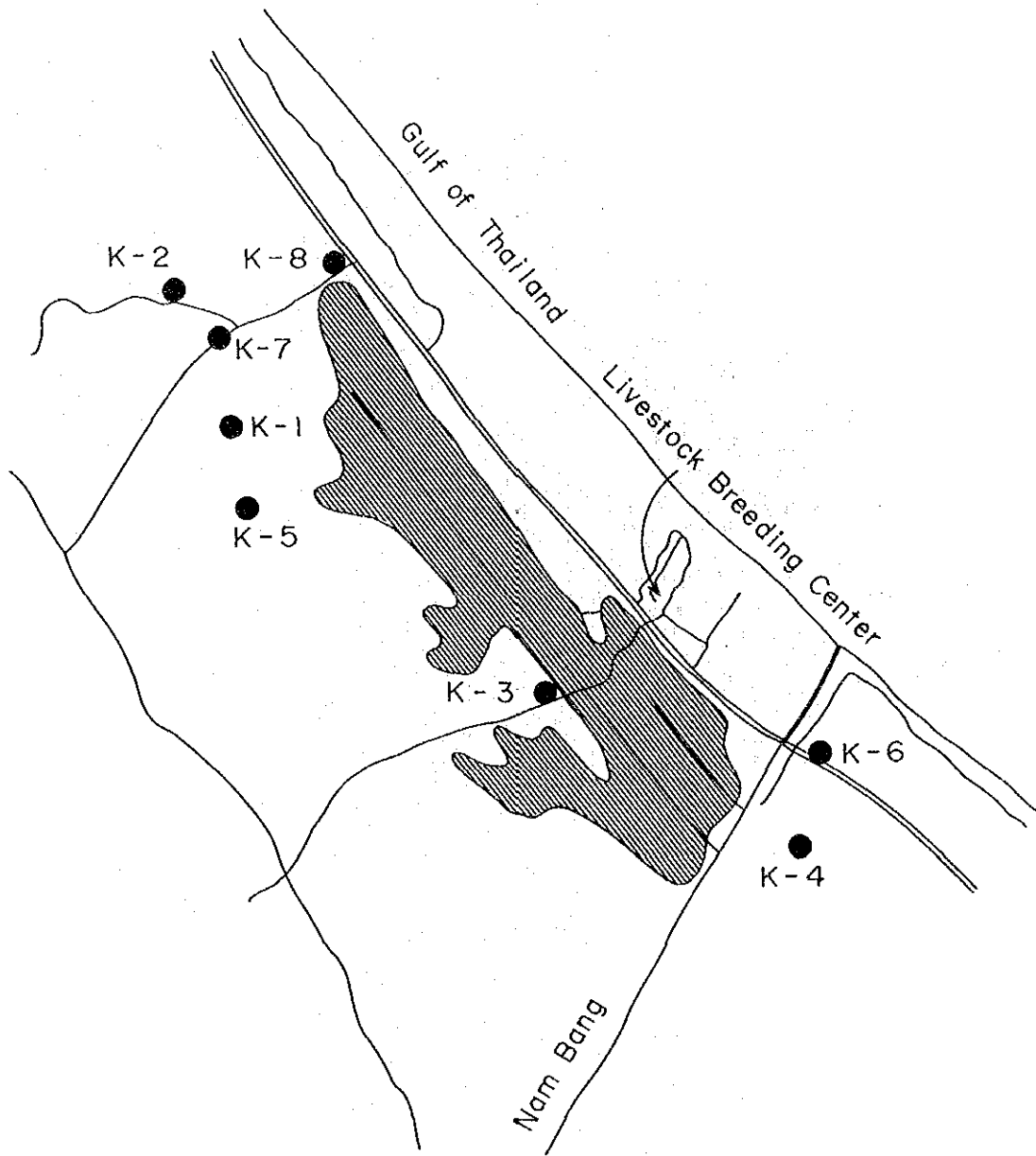


Village





- Legend**
-  Pilot area
 -  Big road
 -  Small road
 -  River/Canal

- B-1-1 Bacho land settlement cooperative(Muslem)
- B-1-2 Bacho land settlement cooperative(Buddist)
- B-2 Ban Bu Ke Chu Do
- B-3 Ban Bu Ke Ya Mu
- B-4 Ban Hu Tae Thu Wo (2)
- B-5 Ban Khok Khian
- B-6 Ban Khok Payom
- B-7 Ban Nikon Sahakan Bacho
- B-8 Ban - Thon
- B-9 Ban Thung Khian

Figure I-2-1 Location of Village Site-Bacho F/S Area

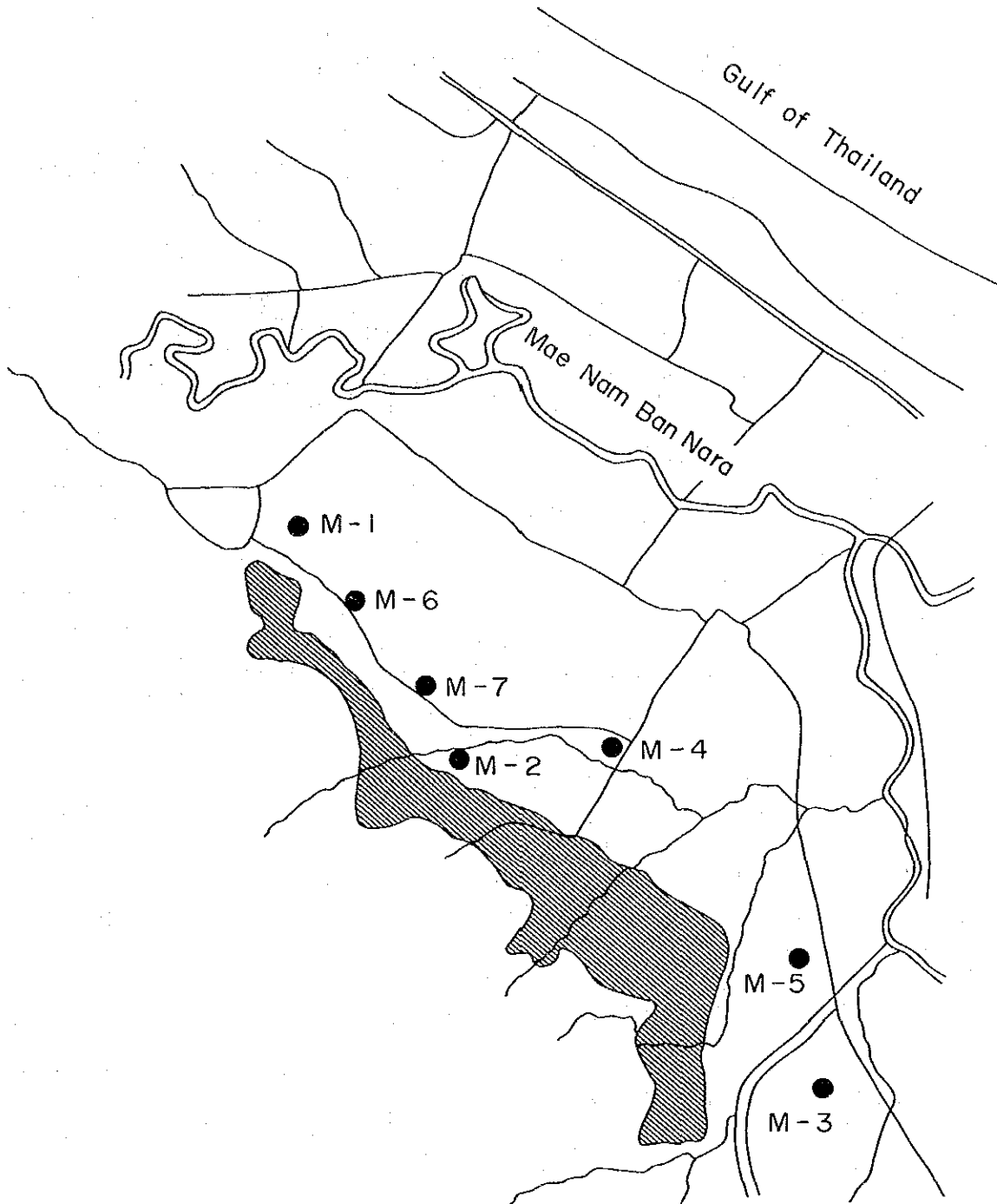


Legend





-  Pilot area
-  Big road
-  Small road
-  River/Canal

- K-1 Ban Ba Ya
- K-2 Ban Chao Ro Sato
- K-3 Ban Khok Kraduk Mu
- K-4 Ban Ko Sawat
- K-5 Ban Ku Bae Salo
- K-6 Ban Ku Bu
- K-7 Ban Pa Pit
- K-8 Ban Sapon

Figure I-2-2 Location of Village Site-Kab Daeng F/S Area



Legend

	Pilot area
	Big road
	Small road
	River/Canal

Village

M-1	Ban Ba Wong
M-2	Ban Khoknai
M-3	Ban Khok Nibong
M-4	Ban Khok Phai
M-5	Ban Khok Yang
M-6	Ban Thung Fai
M-7	Ban Wat Mai

Figure I-2-3 Location of Village Site-Muno Koknai F/S Area

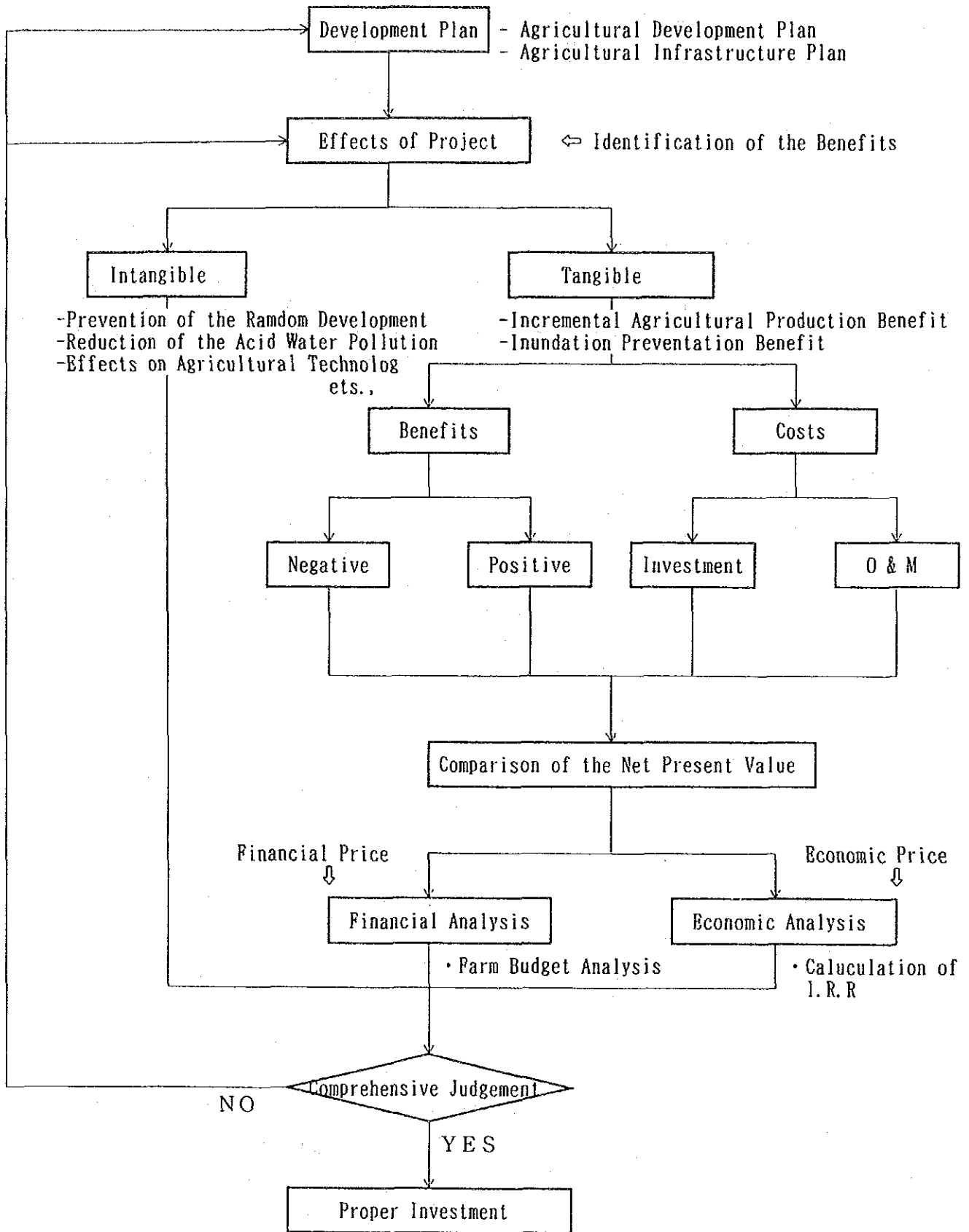


Figure I-3-1 Flow of the Project Evaluation

APPENDIX J. LEACHING TEST IN FIELD LEVEL

APPENDIX J. LEACHING TEST IN FIELD LEVEL

	Page
1. Construction of the Test Plots -----	J - 1
2. Leaching Test in Acid Sulfate Soil -----	J - 4
2-1 Facilities and Measuring Instruments in the Test Plot -----	J - 4
2-2 Method of Leaching Test -----	J - 5
2-3 Progress of the Leaching Test -----	J - 6
2-4 Test Results -----	J - 7
2-5 Groundwater Simulation for Acid Sulfate Soil, Muno Khok Nai -----	J - 13
3. Subsidence Test in Peat Soil -----	J - 27
3-1 Facilities and Measuring Instruments -----	J - 27
3-2 Method of the Subsidence Test -----	J - 27
3-3 Progress of the Subsidence Test -----	J - 28
3-4 Groundwater Simulation for the Peat Soil, Bacho -----	J - 32
4. Data -----	J - 44

LIST OF FIGURES

		Page
Figure 2-1	Layout of Leaching Test Plot in Acid Sulfate Soil -----	J - 2
Figure 2-2	Layout of Test Plot in Peat Soil -----	J - 3
Figure 3-1	Cross Sectional Profile of the A Portion of U1 Plot showing the positions of Tensiometers and Piezometers -----	J - 9
Figure 3-2	PH Improvement by Leaching in the Paddy field - Khok Nai Leaching Test Plot, 1992 --	J - 11
Figure 3-3	Quantity of Outflow and Infiltration Capacity Curve -----	J - 12
Figure 3-4	Quantity of Outflow -----	J - 12
Figure 3-5	Finite Element Mesh of the Model Domain ----	J - 16
Figure 3-6	Soil Moisture Content Variation in the Khok Nai Leaching Plot -----	J - 18
Figure 3-7	Simulated and Observed Pressure Head within the Model Domain -----	J - 21
Figure 3-8	Pressure Head Distribution after 24 hours of Simulation -----	J - 22
Figure 3-9	Pressure Head Distribution after 72 hours of Simulation -----	J - 23
Figure 3-10	Pressure Head Distribution after 120 hours of Simulation -----	J - 24
Figure 3-11	Velocity Vector Plot after 120 hours of Simulation -----	J - 25
Figure 3-12	Water Content Distribution after 120 hours of Simulation -----	J - 26
Figure 4-1	Cross Sectional Profile of the Test Plot in Peat Soil Showing the Positions of Tensiometers and Piezometers -----	J - 30
Figure 4-2	Subsidence Test in the Bacho Swamp Test Plot -----	J - 31
Figure 4-3	Finite Element Mesh of the Model Domain ----	J - 35

		Page
Figure 4-4	Simulated and Observed Hydraulic Head at Location A -----	J - 36
Figure 4-5	Simulated and Observed Hydraulic Head at Location B -----	J - 37
Figure 4-6	Simulated and Observed Hydraulic Head at Location C -----	J - 38
Figure 4-7	Total Head Distribution after one hour of Pumping -----	J - 39
Figure 4-8	Total Head Distribution after two hours of Pumping -----	J - 40
Figure 4-9	Total Head Distribution after three hours of Pumping -----	J - 41
Figure 4-10	Total Head Distribution after four hours of Pumping -----	J - 42
Figure 4-11	Total Head Distribution after five hours of Pumping -----	J - 43

LIST OF TABLES

		Page
Table 3-1	PH Improvement of Paddy Field by Means of Leaching -----	J - 10
Table 3-2	Soil Moisture Contents (%) of the Soil Samples at various PF in Weight basis -----	J - 17
Table 3-3	Parameters Given to the Saturated - Unsaturated Groundwater Flow Model -----	J - 19
Table 3-4	Results of the Saturated - Unsaturated Groundwater Simulation -----	J - 20
Table 3-5	Water Balance of the P1 Paddy Plot -----	J - 45
Table 3-6	Water Balance of the P2 Paddy Plot -----	J - 46
Table 3-7	Water Balance of the P3 Paddy Plot -----	J - 47
Table 3-8	Water Balance of the P4 Paddy Plot -----	J - 48
Table 3-9..18	Variation of Water Quality with Time -----	J - 49
Table 3-19..28	Piezometric Head Variation in the Tree Crop Field in Relation to Canal Stage -----	J - 59
Table 3-29..38	Piezometric Head Variation in the Upland Field in Relation to Canal Stage -----	J - 69
Table 3-39..48	Piezometric Head Variation in the Paddy Field in Relation to Canal Stage -----	J - 79
Table 3-49..62	Piezometric Head Variation in the U1 Plot with Time in Relation to Canal Stage -----	J - 89
Table 3-63..72	Tensiometer Head Variation in Relation to Precipitation, Irrigation and Evaporation Location A -----	J - 103
Table 3-73..82	Tensiometer Head Variation in Relation to Precipitation, Irrigation and Evaporation Location B -----	J - 113
Table 3-83..92	Tensiometer Head Variation in Relation to Precipitation, Irrigation and Evaporation Location C -----	J - 123
Table 3-93..99	Tensiometer Head Variation in Relation to Precipitation, Irrigation and Evaporation Location D -----	J - 133

		Page
Table 4-1	Parameters Given to the Saturated Groundwater Flow Model -----	J - 34
Table 4-2..5	Hydraulic Head Variation during the Sub- sidence Test in Relation to Canal Stage ----	J - 140
Table 4-6..12	Piezometric Head Variation and Subsidence with Time in relation to Canal Stage -----	J - 144
Table 4-13..19	Tensiometer Head Variation in Relation to Rainfall, Evaporation from Ground and the Canal Stage - Location A -----	J - 151
Table 4-20..27	Tensiometer Head Variation in Relation to Rainfall, Evaporation from Ground and the Canal Stage - Location B -----	J - 158
Table 4-27..33	Tensiometer Head Variation in Relation to Rainfall, Evaporation from Ground and the Canal Stage - Location C -----	J - 165
Table 4-34..40	Tensiometer Head Variation in Relation to Rainfall, Evaporation from Ground and the Canal Stage - Location D -----	J - 172

J. Leaching Test in Field Level

1. Construction of the test plots

Two test plots were constructed in the F/S areas, one nearby Khok Nai i.e. a village in the Muno-Khok Nai F/S area, the other in the middle of the Bacho F/S area.

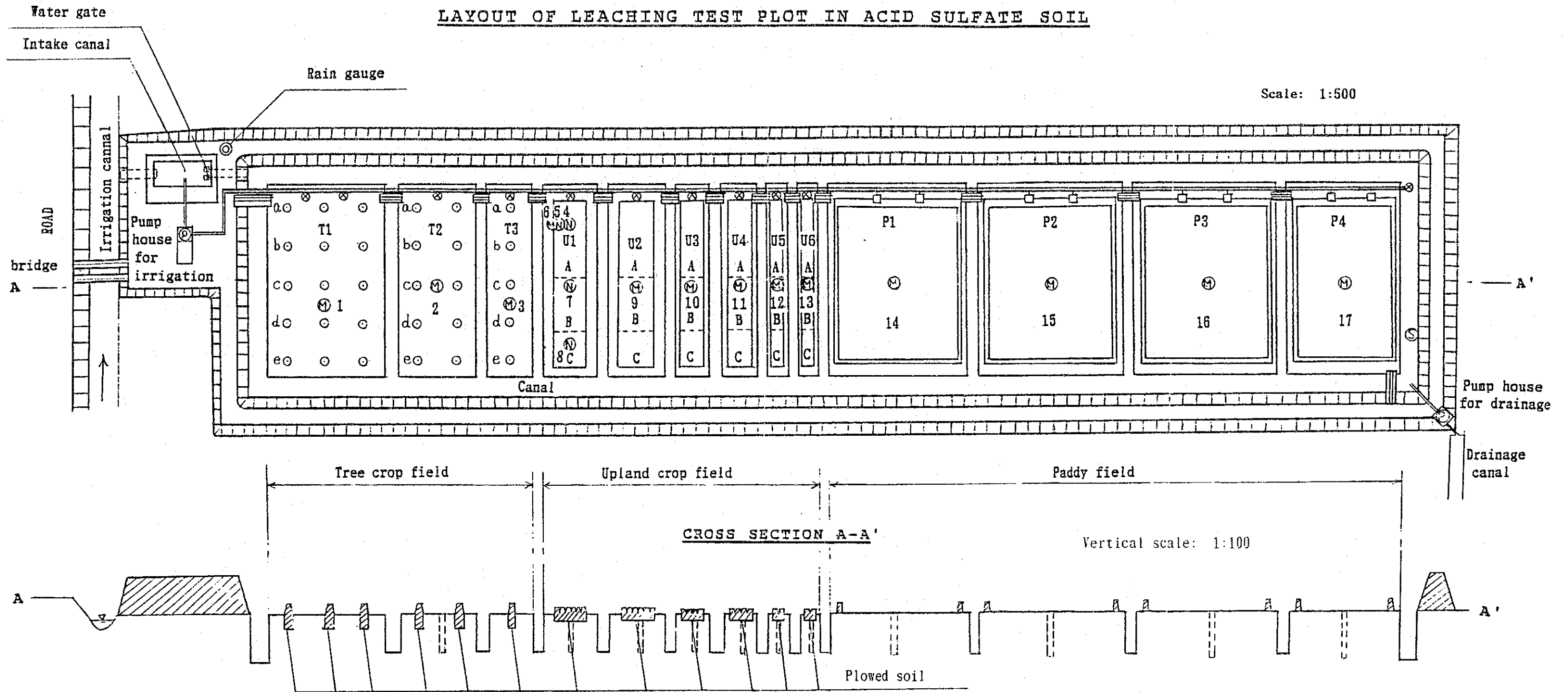
This test plot in Khok Nai is aimed to conduct leaching tests in the acid sulfate soil under a proper water management. The test plot has a dimension of 25m×150m, being surrounded by a drainage canal and an embankment. The test plot is subdivided into three (3) fields i.e. tree crop field, upland crop field and paddy field. Each field is subdivided into subplots, such as the tree crop field into three (3) subplots, the upland crop field into six (6) subplots and the paddy field into four (4) subplots. The layout of this test plot is shown in Fig. 2-1.

The test plot in the Bacho F/S area is aimed to observe the subsidence of the peat layer and the water movement in the peat layer caused by drainage. It is also aimed to observe the long term subsidence and swelling. This test plot has a dimension of 10m 10m, being surrounded by a drainage canal and an embankment as shown in Fig. 2-2.

The embankment founds on the marin clay laid under the peat layer in order to avoid the seepage from the outside.

Figure 2-1

LAYOUT OF LEACHING TEST PLOT IN ACID SULFATE SOIL



LEGEND

- ⊕ Pump + diesel engine
- ⊖ piezometer 108cm below GL
- ⊙ tensiometer 10cm below GL
- ⊙ 30cm below GL
- ⊙ 60cm below GL
- ⊖ piezometer 108cm below GL
- ⊙ Staff gauge 2m long
- ⊗ 1" valves ⊕ 1" valve + concrete basin

Arable area

- T1: 16m × 25m
- T2: 10m × 25m
- T3: 8m × 25m
- P1: 16m × 20m
- P2: 16m × 20m
- P3: 16m × 20m
- P4: 12m × 20m
- U1: 4.5m × 22m
- U2: 4.5m × 22m
- U3: 3m × 22m
- U4: 3m × 22m
- U5: 1.5m × 22m
- U6: 1.5m × 22m

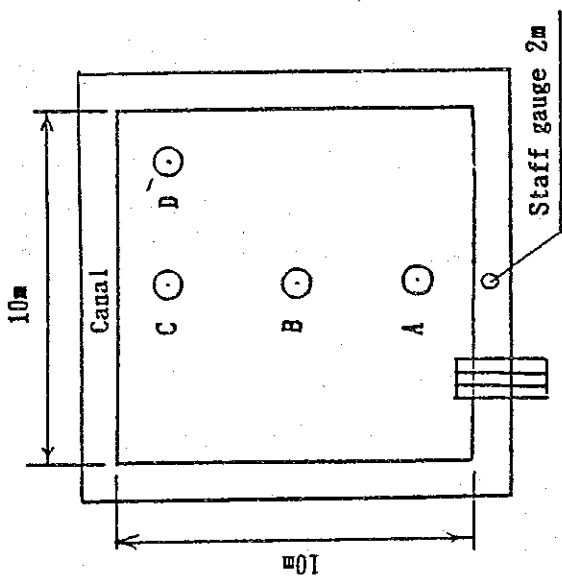
Lime application

- Tree crop
 - a 2Kg/heap i.e 800Kg/a 50cm below the top the heap
 - b " " 60cm "
 - c " " 70cm "
 - d " " 80cm "
 - e " " 90cm "
- Upland crop
 - A 180Kg/a 10m long lime in mixture
 - B 540Kg/a 7m long lime in layer at the bottom of the plowed soil
 - C nil 5m long

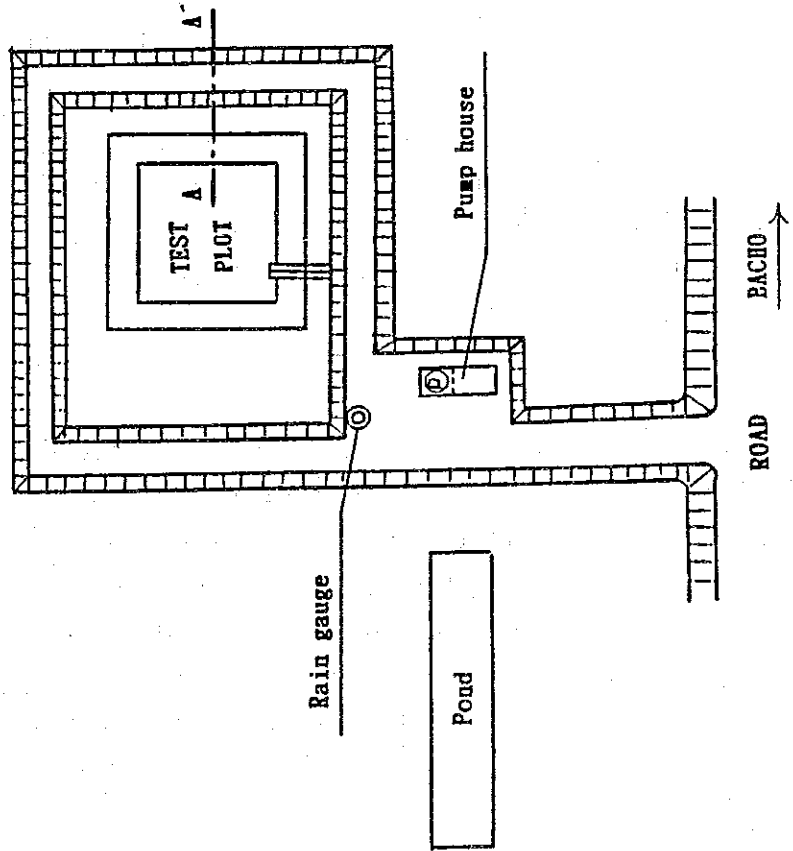
LAYOUT OF TEST PLOT IN PEAT SOIL

INSTRUMENTS

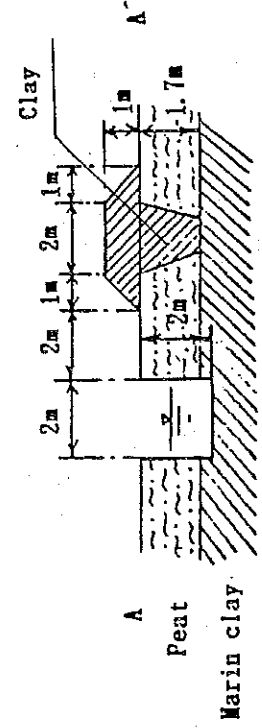
Location A	Tensiometer	10cm below GL
		25cm
		60cm
	Piezometer	100cm
		150cm
Location B	Iron rod	3m long
	Tensiometer	10cm below GL
		25cm
		60cm
	Piezometer	100cm
		150cm
Location C	Tensiometer	10cm below GL
		25cm
		60cm
	Piezometer	100cm
		150cm
Location D	Tensiometer	10cm
		25cm
		60cm
	Piezometer	150cm



TEST PLOT



Cross section A - A'



Scale: 1:500

Figure 2-2 Scale: 1:200

2. Leaching Test in Acid Sulfate Soil

2-1 Facilities and measuring instruments in the test plot

For supplying leaching water, the following facilities and instruments were provided.

Pump house 2mX5m	1 no.
3" pump + diesel engine	1 set
3" PVC pipe line	160 m
3" valves	3 nos.
3" check valves	2 nos.
3" flow meter	1 no.

At each subplot one tap is at least provided. The taps are of one (1) inch diameter. For each subplot of the paddy field, two (2) taps are provided. Leaching water is supplied by flooding method to the plots flowing out from the basins provided at the taps. For the subplots in the tree crop field and the upland crop field, leaching water is spread by plastic hoses connecting with the taps.

For drainage from the test plot, the following facilities and instruments were provided.

Pump house 2mX2m	1 no.
3" pump + diesel engine	1 set
3" flow meter	1 no.

Three (3) inch PVC pipes are connected with the pump and the flow meter.

In order to measure the hydrological and the hydraulic conditions, the following instruments were provided.

Rain gauge with recorder	1 no.
Wet bulb and dry bulb thermometer	1 set
Staff gauge 2m	1 no.
Piezometer	17 nos.
Tensiometers	12 nos.

Five (5) piezometers and all the tensiometers were installed in the U1 subplot in order to observe the groundwater movement including the soil moisture, which may much differ from place to place because of the different lime applications. The tensiometers were installed at four (4) places in the subplot and set at three different depths i.e. 10cm, 30cm and 60cm below the top of the ridges.

In a portion of the U1 subplot where the plowed layer is mixed with lime, three (3) piezometers and six (6) tensiometers were installed along the cross section of the subplot in order to measure the groundwater movement including the soil moisture more in detail (see Fig.3-1).

The remaining piezometers were installed in the center of each subplot.

2-2 Method of the leaching test

This test is aimed to know how much of water is needed to amend the acidity of surface soil by supplying fresh water to the plots under a proper water management.

Leaching water shall be supplied as scheduled, and the quantity of supplied water must be recorded daily as well as its quality. The water level in the drainage canal must be kept as low as possible. It is recommended to keep the water level at 1.0m of the staff gauge i.e. about 50cm below the ground level in practice. The drainage operation is recorded daily in terms of its quantity, the water quality and the water level.

The rules and the schedule of supplying leaching water to the plots are as follows.

For the paddy field, the period of leaching was varied with the subplots.

Subplot index	Period of leaching
P1	5 days
P2	20 days
P3	10 days
P4	30 days

The leaching operation is repeated until the PH of soil at the depth of 10cm becomes above 4.5. Between the leaching periods the top soil are plowed, after the ponding water being drained. PH and EC of soil are measured at those times. The soil samples are taken at the depths of 10cm, 30cm and 60cm. The water depth of the paddies during the leaching periods are maintained at between 10cm and 20cm deep.

For the tree crop field, leaching water is supplied to the embanked where trees will be planted until the soil of the heaps are fully saturated. PH and EC of the soil are measured every month, taking the samples at the depths of

10cm, 30cm and 60cm below the top of the heaps. This operation continues until the soil of PH at the depth of 10cm becomes above 5.

For the upland crop field, leaching water is supplied to the furrows until the soil of the heaps is fully saturated. PH and EC of the soil are measured every month, taking the samples at the depths of 10cm, 30cm and 60cm below the top of the heaps. This operation continues until the soil of PH at the depth of 10cm becomes above 5 as same as the tree crop field.

2-3 Progress of the leaching test

The leaching test in the paddy field was commenced after plowing the subplots in the beginning of November.

The starting date of supplying leaching water is as follows. The reason why the dates are different on the subplots is that there are many vertical cracks in the subsoil layer and the permeability is higher than the expected. Therefore, it was not possible to fill all the paddies with water at once.

Subplot index	The starting date of supplying leaching water
P1	Nov. 6th
P2	Nov. 9th
P3	Nov. 10th
P4	Nov. 4th

In meantime, there were troubles such as engine trouble of the pump, absence of observers, absence of plowing. However, PH of the soil had improved and became above the target value 4.5 in every paddy (see Table 3-1) in the mid December. PH of soil in P4 was not measured in December.

In this period, PH of leaching water was varied between 3.5 and 5.4 (see Table 3-9 to Table 3-18). The relation between the quantity of leaching water and the PH of soil shown in Fig. 3-2 shows us about 3000mm of water was supplied to P1 and P3 until Dec. 1st and amended the soil at the depth of 10cm from PH3.3 to PH4.3. In the same period, PH of soil at the depth of 30cm and 60cm in P3 improved more than the one in P1. This means water percolated into the subsoil layer is more in P3 than in P1.

This is because the plowed soil of P1 became less permeable than the one of P3 since P1 was plowed one time more.

In the tree crop field and the upland crop field, leaching water was not supplied other than rainfall until the late of February. Soil sampling was not conducted in the period, therefore the effect of leaching is not known.

The data in the period such as water level of the drainage canal, total heads observed by the piezometers, pressure heads observed by the tensiometers are listed in Table 3-19 to Table 3-99, being compiled by field by field.

Groundwater simulation will be conducted using these data.

2-4 Test results

Concerning the leaching test conducted in the paddy field, we hereby discuss the cases of P1 and P3, since the data of the two subplots are relatively well provided. As described before, about 3000mm of water was supplied to those subplots until Dec. 1st and the soil at the depth of 10cm was amended from PH3.3 to PH4.3 by the water.

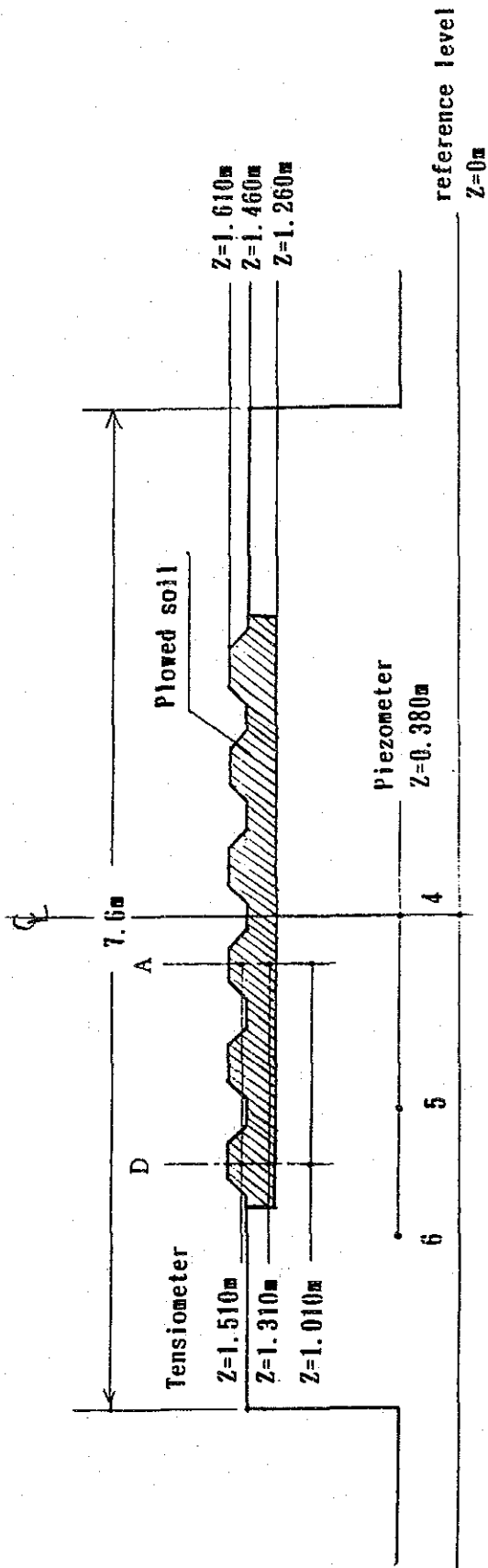
In P1, since considerable quantity of water was overflowing and leaking from the borders on several days, we cannot neglect the quantity. Making a graph with time series outflow(output) data obtained by the water balance analysis, we can find some dissected periods in which outflow seems corresponding to infiltration. Connecting these points, we can draw two curved lines before and after Nov. 11th which resemble the infiltration capacity curves (see Fig.3-3). If it is allowed to count the quantity exceeding the infiltration capacity as the overflow and the leakage, the apparent infiltration quantity is summed at about 1880mm. Subtracting the evaporation rate which is about 60mm in the period at the Muno project, more than 1800mm of water is considered to have been infiltrated and effective to leach the soil. We guess from this calculation that more than 1900mm of water must be infiltrated in order to amend the soil of PH3.3 to the target value PH4.5.

In P3, it was not able to draw a infiltration curve on the time series graph of outflow as the data are dispersed in the graph. However, there was no report of outflow or leakage from the borders. Therefore, we think that almost

all the leaching water i.e. about 2900mm was infiltrated and effective to leach the soil.

Since such a large quantity of water is needed for leaching, our advice for the leaching method to be applied for this type of soil is save-water by means of making the permeability of the plowed soil less and the percolation to the subsoil less, plowing the top soil a few times at the beginning of the leaching operation.

Being based on the result of P1, the leaching water to be needed to amend the acid sulfate soil in the Muno-Khok Nai area to the one of PH4.5 is about 2000mm under the good water management. This quantity includes evaporation and precipitation.



scale: 1:50

The numbers are the piezometers indices.
 The alphabets are the location indices.

Figure 3-1 Cross Sectional Profile of the A Portion of U1 plot showing the Positions of Tensiometers and Piezometers

Table 3-1
PH Improvement of Paddy Field by Means of Leaching

Khok Nai Leaching Test Plot , 1992

Date	5/	12/	17/	20/	1/	18/	22/	23/	24/	5/	10/	23/	Remarks
Plot	cm	11	11	11	12	12	12	12	12	12	1	1	
P1	10	3.35	3.5	3.54		4.30	4.81		5.07		4.45	4.89	5day leaching repetition
	30	3.28	3.5	3.34		3.85	4.40		4.83		4.35	4.66	
	60	3.20	3.3	3.26		3.80	4.23		4.72		4.27	4.48	
P2	10	3.35	3.4					4.95					20day
	30	3.25	3.3					4.82					
	60	3.23	3.2					4.73					
P3	10	3.30	3.5		3.64	4.30		5.10				4.89	10day
	30	3.33	3.4		3.72	4.10		4.96				4.58	
	60	3.31	3.38		3.70	3.95		4.72				4.42	
P4	10	3.55	3.38							4.82			30day
	30	3.45	3.38							4.31			
	60	3.35	3.32							4.27			

Figure 3-2 PH Improvement by Leaching in the Paddy Field
 Khok Nai Leaching Test Plot, 1992

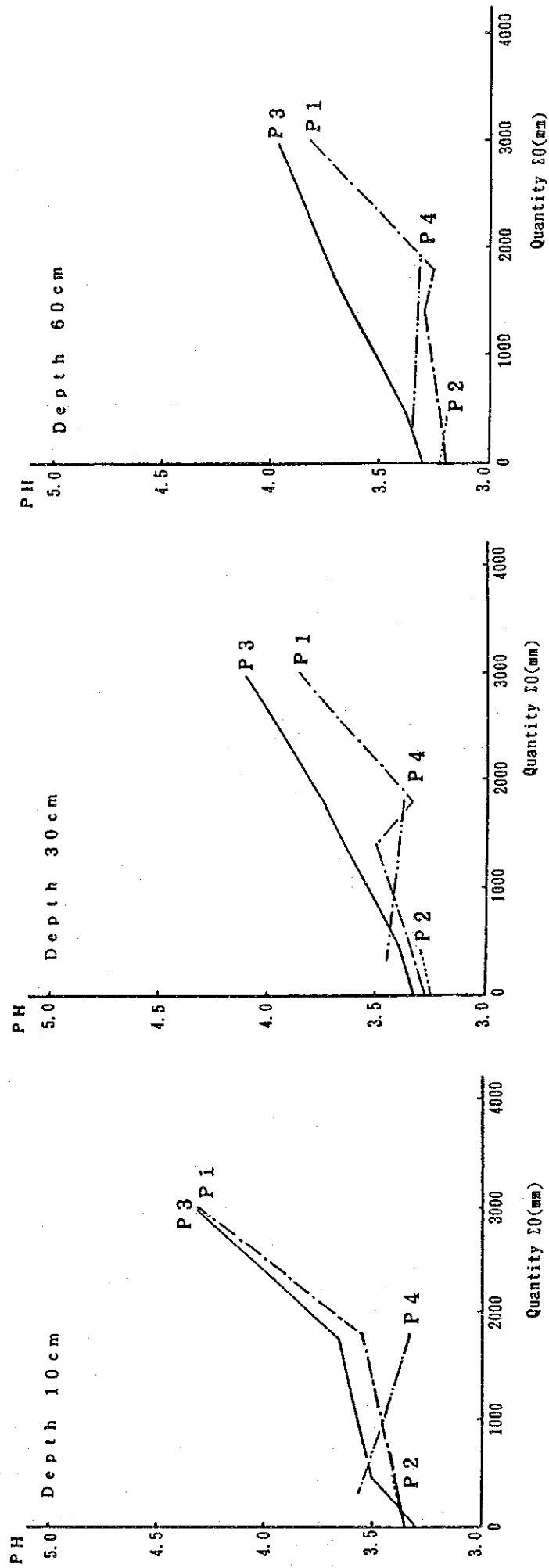


Fig. 3 - 3

Quantity of Outflow and Infiltration Capacity Curve

P1. Khok Nai Leaching Test Plot

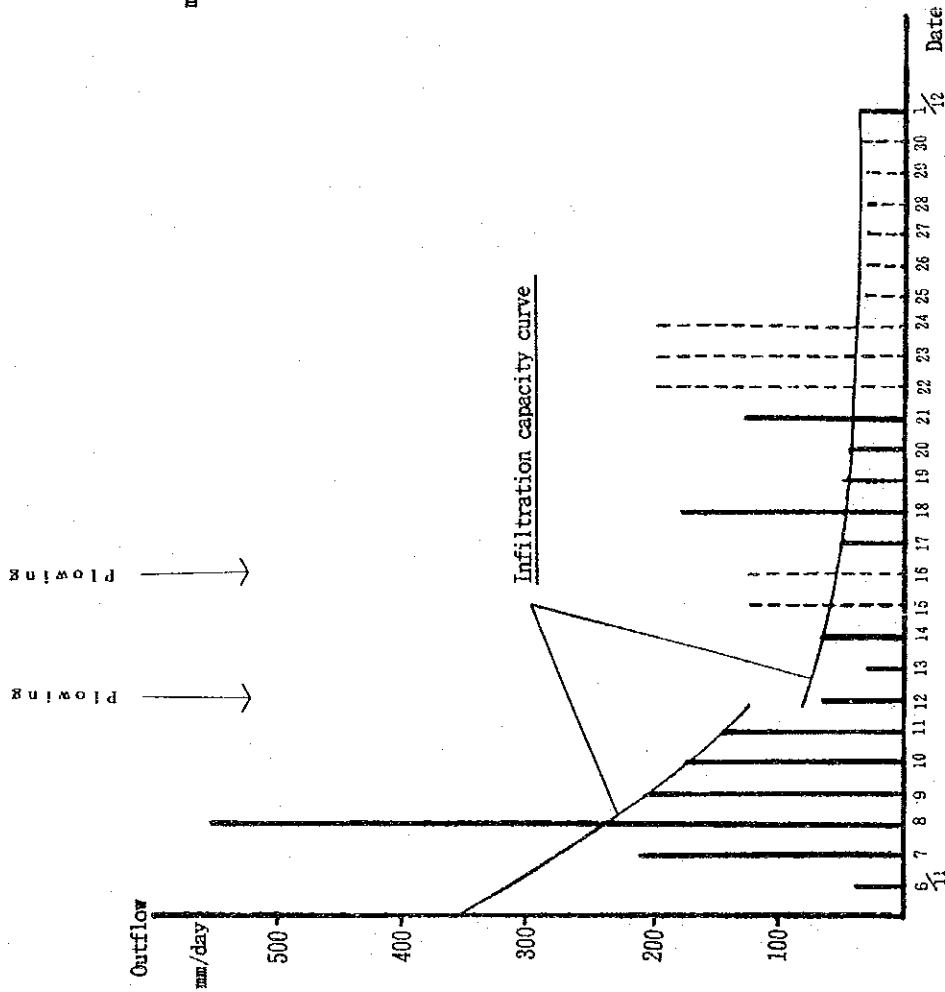
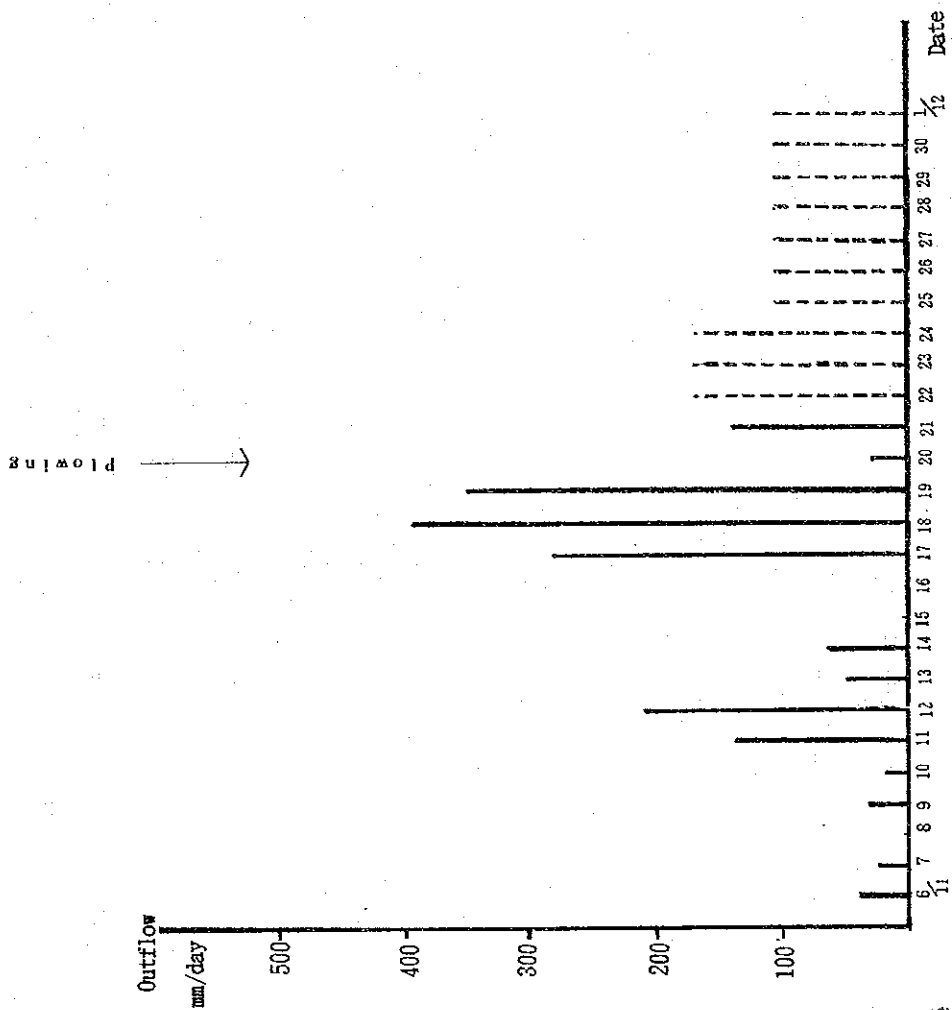


Fig. 3 - 4

Quantity of Outflow

P3. Khok Nai Leaching Test Plot



— Quantity of Outflow per day calculated by water balance
----- Averaged quantity of outflow per day

2-5 Groundwater Simulation for Acid Sulfate Soil, Muno Khok Nai

2-5-1 Model Outline

The cross sectional area of the leaching test plot U1 shown in Fig. 3-1 was selected for simulation modeling. The unsaturated-saturated groundwater flow was simulated for the period starting from December 16, 1992 and ending on December 21, 1992. There was no appreciable precipitation during this simulation period and thus the drying stage was simulated.

The model domain was divided into finite elements and the mesh was created. There were 246 elements and 293 nodes. The finite element mesh was shown in Fig.3-5. The soil moisture content of the plowed and the unplowed layer, shown in Fig.3-6 was used for the model simulation.

The unsaturated soil moisture contents of weight basis were observed at various PF in the DLD laboratory as shown in Table 3-2 and converted to those of volume basis assuming

$$\frac{Ww-Wd}{Wd} = \frac{Wpf-Wd}{Wd} \quad \text{at PF}=0.5$$

The method of conversion for the soil moisture content from weight basis to volume basis is described in Section 2-5-3. The parameters given to the model are shown in Table 3-3.

The boundary condition for the model domain were

- a) Rainfall-Seepage at the top boundary
- b) No flow boundary at the middle of the cross section so that the left half is the model domain
- c) Prescribed total head at the bottom boundary nodes.

The total heads along the boundary nodes are interpolated linearly from the observed piezometric heads.

- d) Time varying canal head at the left side boundary

The initial condition is as follows:

For the nodes above the groundwater table, their elevation head is given as their initial value and for the nodes below the groundwater table, their total head is given as the initial value. The ground water table is estimated from the observed head.

The time step size of the simulation was 10 minutes and the simulated results are printed out at every 60 minutes (1 hour).

The simulation results are compared with the observed one by changing the evaporation rate from $4.07E-05$ cm/sec to $4.07E-07$ cm/sec, assuming the evaporation is constant for the period.

2-5-2 Simulation Results

The computer model produced the following results for the given initial and boundary conditions.

- a) The pressure head
- b) The velocity vector in each element
- c) The saturation and water content

All the above outputs are obtained for each node or element over the time period at the specified time.

The simulation was close to the observed data, when the evaporation rate was $4.07E-07$ cm/sec. The simulated pressure head at 10 cm, 30 cm, and 60 cm depths were compared with the observed pressure head and their comparisons were shown in Table 3-4 and Fig.3-7.

The distribution of pressure head contours within the cross section were shown in Fig.3-8, 3-9 and 3-10 respectively. The velocity vector on December 21 was shown in Fig.3-11. The saturation water content after the end of simulation (120 hours) were shown in Fig.3-12.

Since the rainfall data obtained from the automatic rainfall recorder was not in good quality, the simulation for the rainy periods was not carried out.

As a result, it can be concluded that the model is at least applicable for simulating the saturated and unsaturated ground water flow in the drying stage.

2-5-3 Moisture Content Conversion

The soil moisture content on volume basis can be calculated as follows.

$$Mv(pf) = \frac{W_{pf} - W_d}{V} \quad (1)$$

Where, W_{pf} = Weight of soil at certain pf

W_d = Weight of dry soil

V = Volume of soil sample

The soil moisture content on weight basis can be calculated as follows.

$$M_w(pf) = \frac{W_{pf} - W_d}{W_d} \quad (2)$$

The soil moisture content of the fully saturated soil can be obtained by the laboratory and is given by

$$M_v(pf=0) = \frac{W_w - W_d}{V} \quad (3)$$

Where, W_w = Weight of fully saturated soil

Multiply equation (2) and (3) and let us say the product

$$C = \frac{W_w - W_d}{V} * \frac{W_{pf} - W_d}{W_d}$$

After rearranging

$$C = \frac{W_w - W_d}{W_d} * \frac{W_{pf} - W_d}{V}$$

Therefore, the soil moisture content on volume basis at a certain pf is calculated as

$$M_v(pf) = \frac{W_{pf} - W_d}{V} = \frac{C}{\frac{W_w - W_d}{W_d}}$$

Where, we assume at $pf=0.5$

$$\frac{W_w - W_d}{W_d} = \frac{W_{pf} - W_d}{W_d}$$

Table 3-2 Soil Moisture Contents (%) of the Soil Samples at various PF in Weight Basis

Series	PF 0.0 (Volume Basis)	PF 0.5	PF 1.0	PF 1.5	PF 1.8	PF 2.0	PF 2.2	PF 2.6
B-1- 15/25	89.3	785.9	553.3	621.0	604.6	456.5	524.3	384.9
B-1- 40/50	87.3	858.7	796.2	751.5	620.9	503.5	590.1	469.6
B-1- 60/70	87.7	734.7	831.4	737.4	779.1	512.9	504.5	438.8
B-1- 80/90	91.7	896.3	906.2	808.6	765.2	667.5	661.6	536.5
B-1- 110/120	91.6	949.3	937.5	818.7	790.3	593.9	657.4	554.9
B-1- 140/150	87.7	188.7	158.6	163.8	170.8	167.8	154.2	138.1
B-1- 170/180	N.A.	175.3	161.5	166.9	160.9	118.2	134.2	99.6
K-1- 20/30	58.8	39.5	39.5	40.6	40.7	39.5	37.4	37.3
K-1- 30/40	60.6	50.4	46.1	40.8	38.1	35.5	37.2	34.3
K-1- 40/50	61.4	43.7	41.1	39.7	37.5	39.5	37.9	39.2
K-2- 5/15	36.8	70.7	52.5	52.6	44.9	41.3	43.5	41.2
K-2- 20/30	50.3	58.6	42.8	48.6	46.1	51.2	50.1	47.1

Remarks:

B-1: Samples obtained nearby the subsidence test plot, Bacho.

K-1: Samples obtained nearby the leaching test plot, Khok Nai.

K-2: Samples obtained from the plowed soil of the upland field, the leaching test plot, Khok Nai.

30/40: Sample obtained from the depth between 30 cm and 40 cm.

Fig. 3-6 Soil Moisture Content Variation in the Khok Nai Leaching Plot

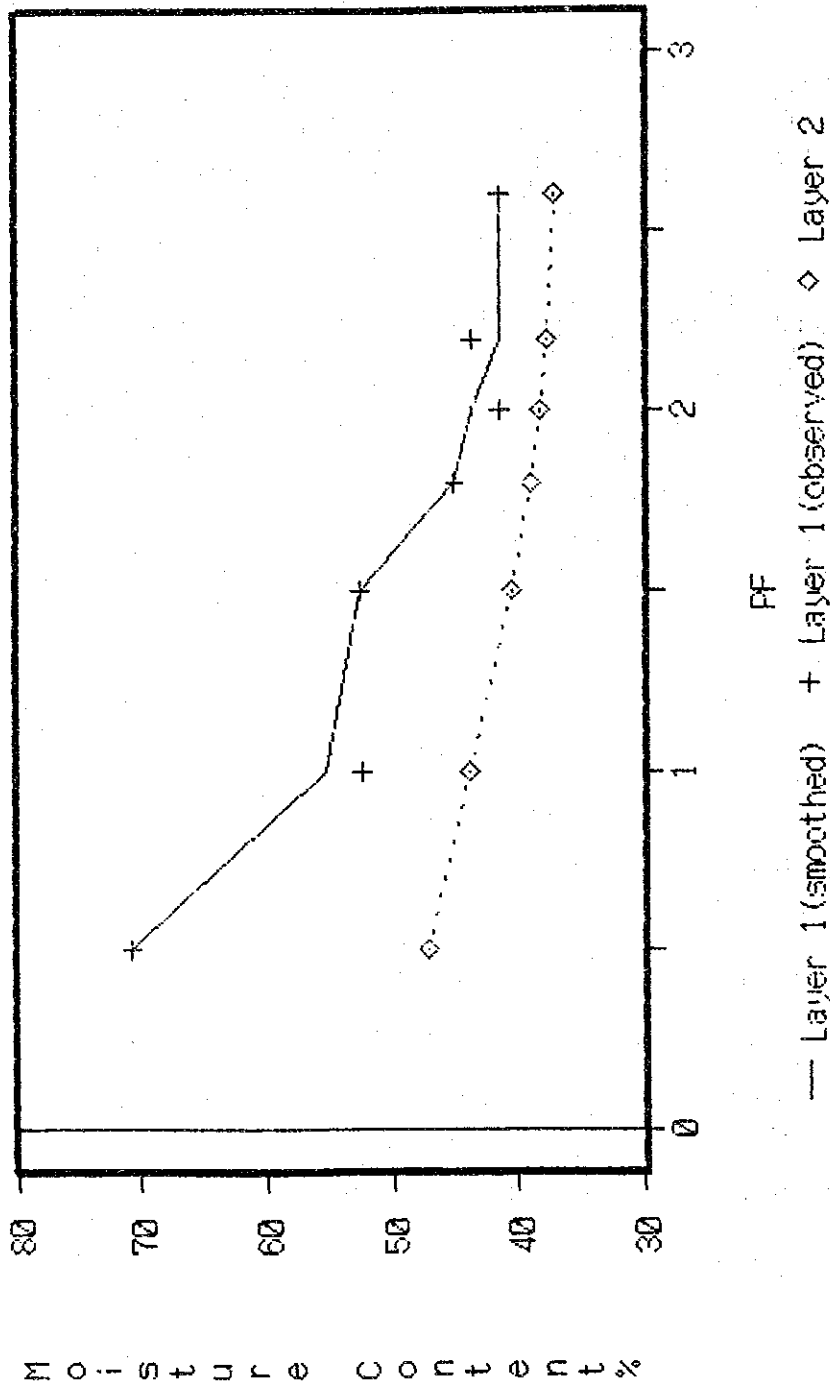


Table: 3-3 Parameters given to the Saturated - Unsaturated Groundwater Flow Model

	Layer 1	Layer 2
Soil Type	Plowed Layer	Clay
Thickness (cm)	35 cm	126 cm
Permeability (cm/sec)	1.50×10^{-3}	1.8×10^{-3}
Porosity (%)	25	20
Bulk density (gm/cc)	1.2	1.0
Residual saturation	0.15	0.25
Derivative of saturation as a function of pressure	5×10^5	5×10^5
Relative permeability as a function of pressure	1.0	1.0

Table: 3-4 Results of the saturated-unsaturated groundwater simulation
Muno Khok Nai

Node Number in the mesh	Depth from the ground level (cm)	Date of Observation	Observed pressure head (cm)	Simulated pressure head (cm)
261	10	16-Dec-1992	0.0	-0.15
		17-Dec-1992	0.0	-0.45
		18-Dec-1992	0.0	-0.60
		19-Dec-1992	-0.952	-0.71
		20-Dec-1992	-1.360	-0.50
		21-Dec-1992	-2.040	-0.44
258	30	16-Dec-1992	0.0	0.15
		17-Dec-1992	0.0	-0.15
		18-Dec-1992	-0.408	-0.30
		19-Dec-1992	-0.544	-0.41
		20-Dec-1992	-0.680	-0.20
		21-Dec-1992	-0.544	-0.14
256	60	16-Dec-1992	0.0	0.46
		17-Dec-1992	-0.408	0.16
		18-Dec-1992	-0.544	0.00
		19-Dec-1992	-0.544	-0.11
		20-Dec-1992	-0.544	0.00
		21-Dec-1992	-0.408	0.16

Fig. 3-7 Simulated and Observed Pressure Head within the Model Domain

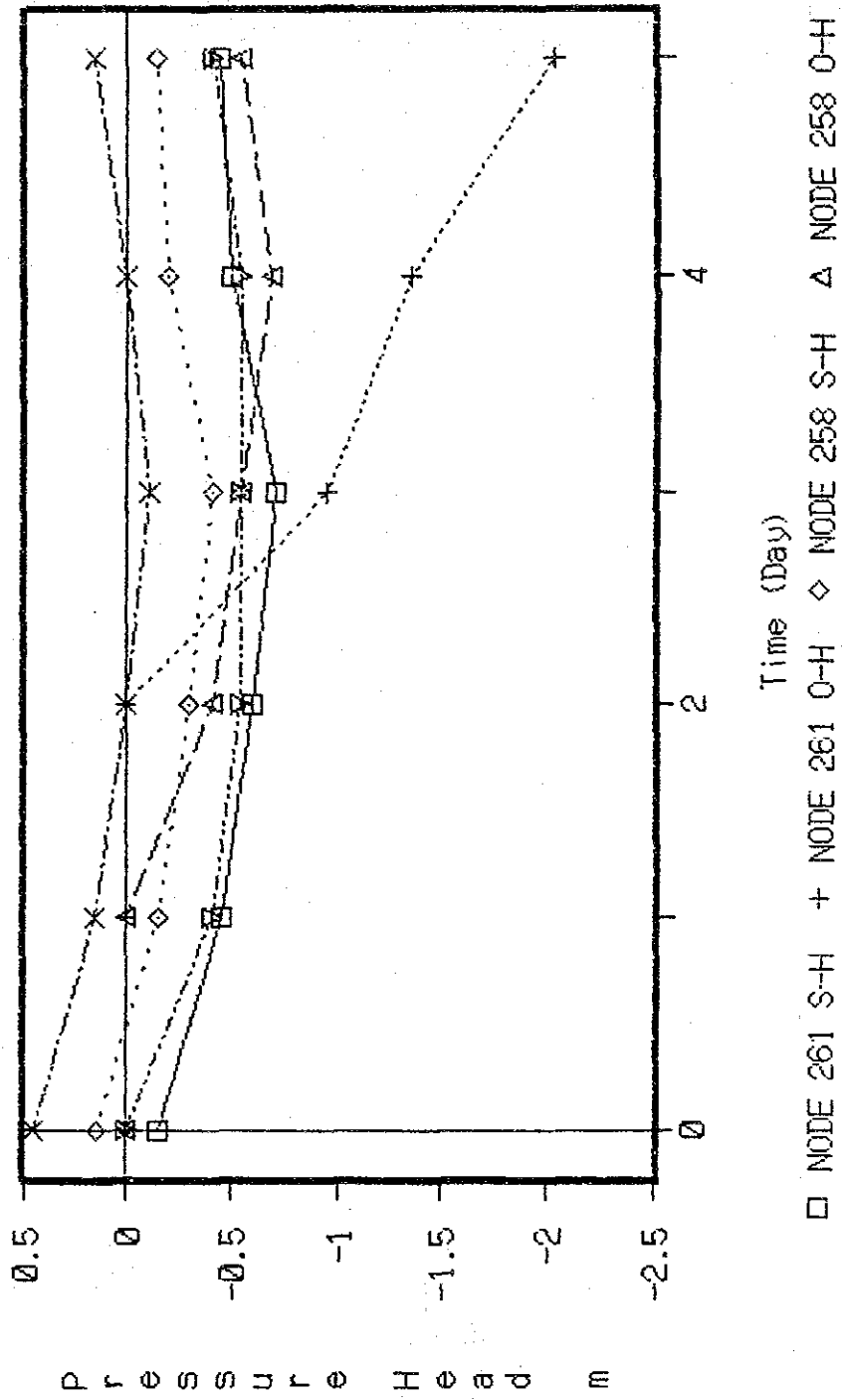
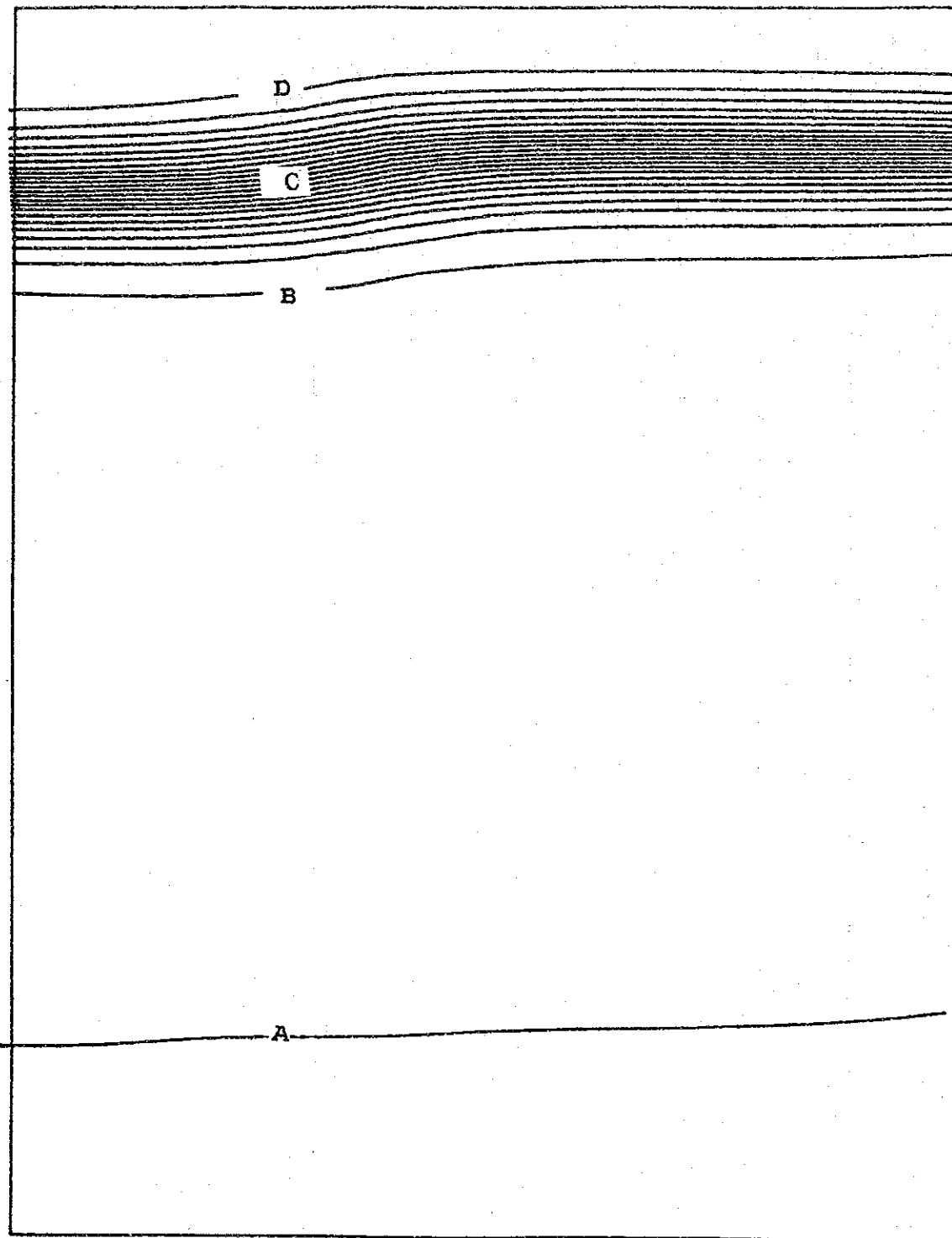
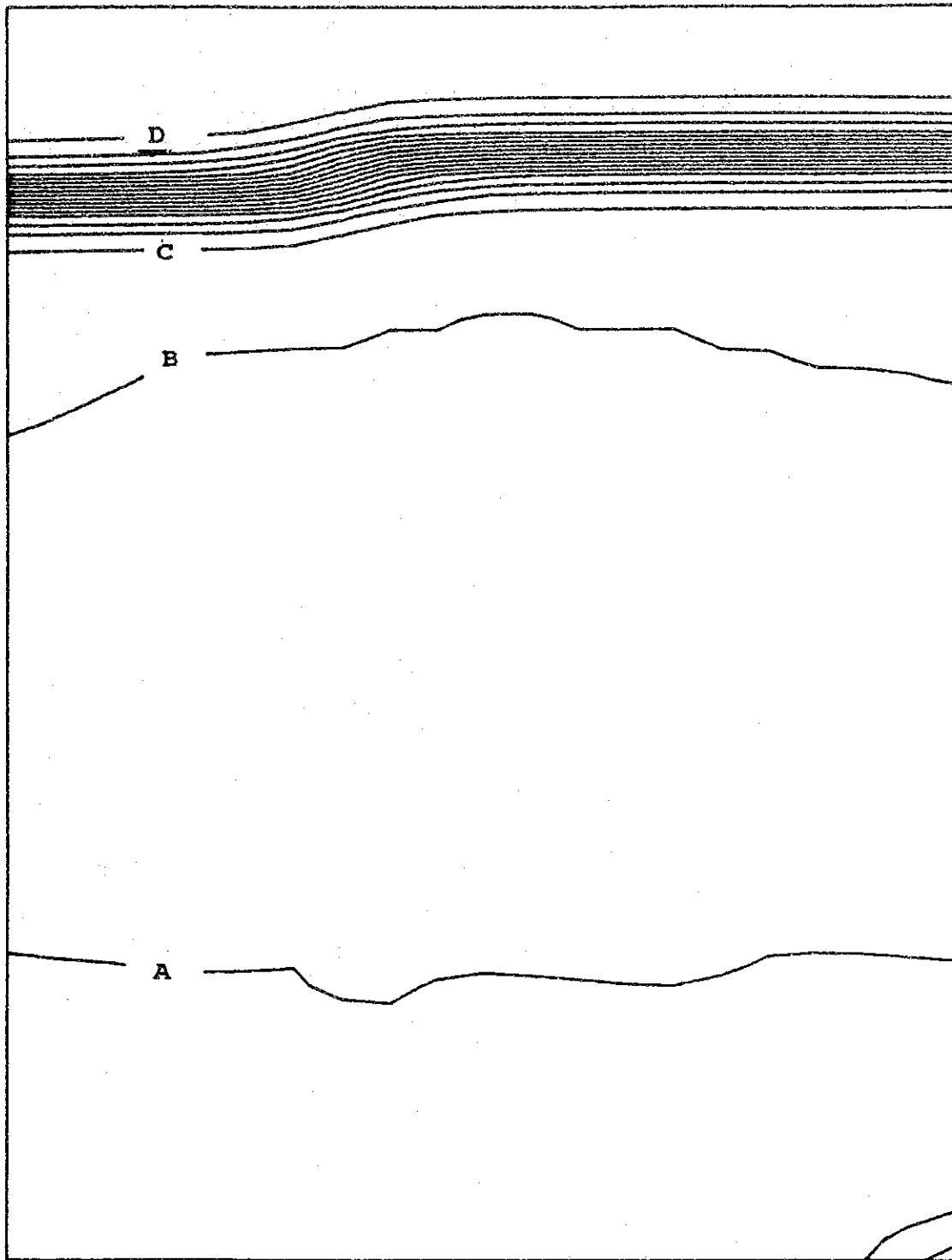


Fig. 3-8 Pressure Head Distribution after 24 hours of Simulation



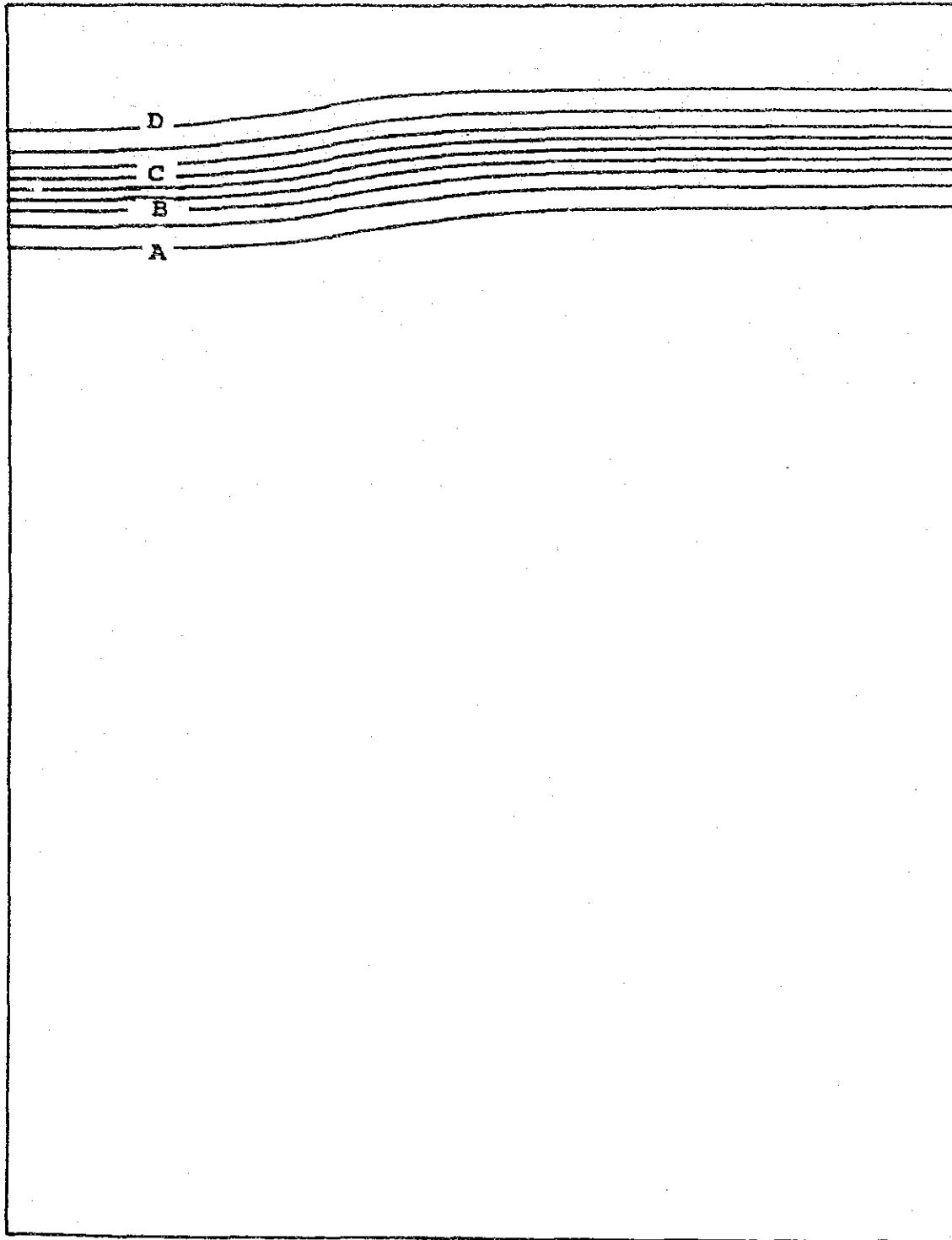
A = +0.15 m
B = -0.10 m
C = -0.20 m
D = -0.30 m

Fig. 3-9 Pressure Head Distribution after 72 hours of Simulation



A = +0.3 m
B = +0.0 m
C = -0.4 m
D = -0.2 m

Fig. 3-10 Pressure Head Distribution after 120 hours of Simulation



A = +0.2 m
B = +0.0 m
C = -0.2 m
D = -0.4 m

Fig. 3-11

Velocity Vector Plot after 120 hours of Simulation

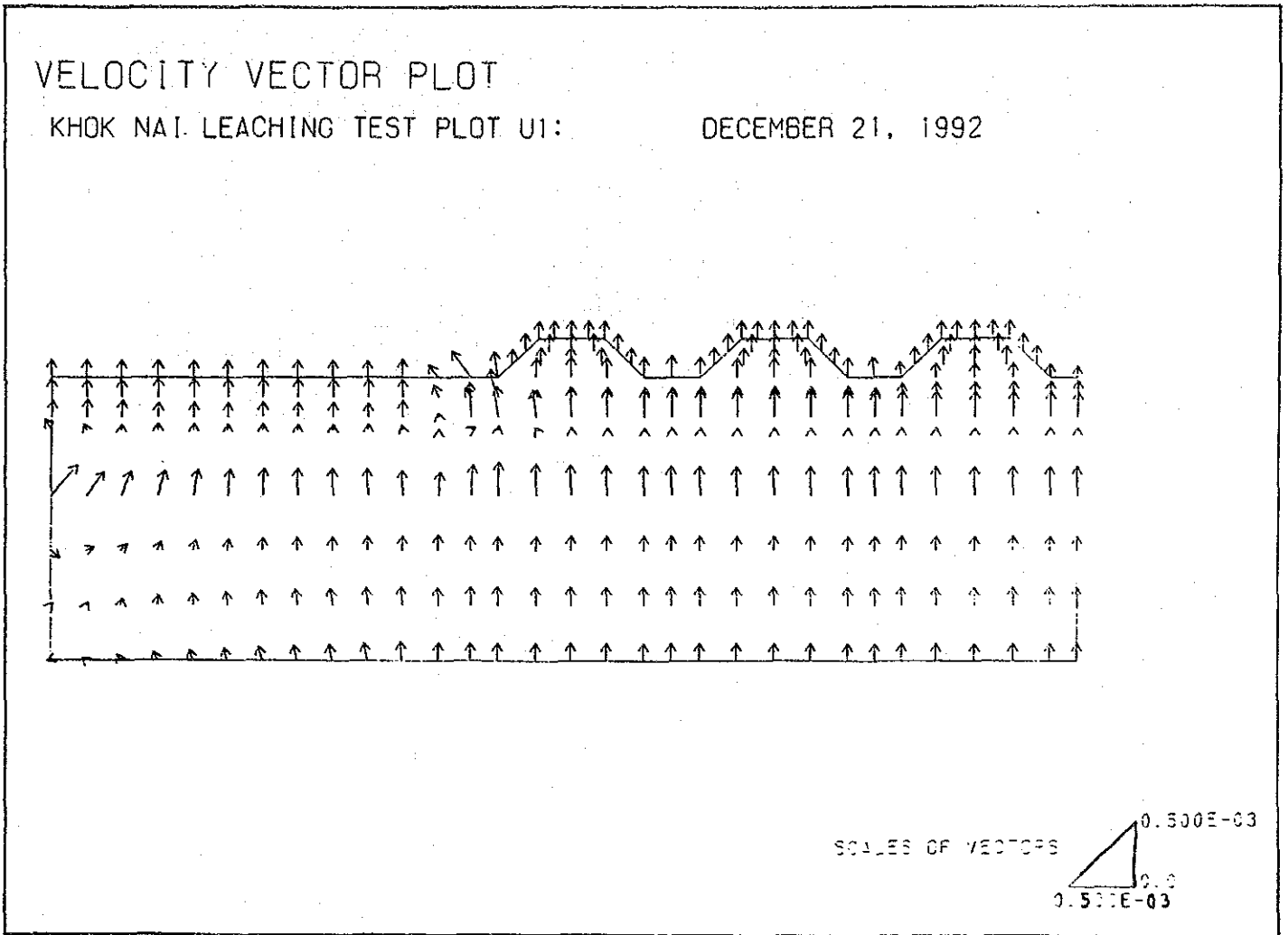
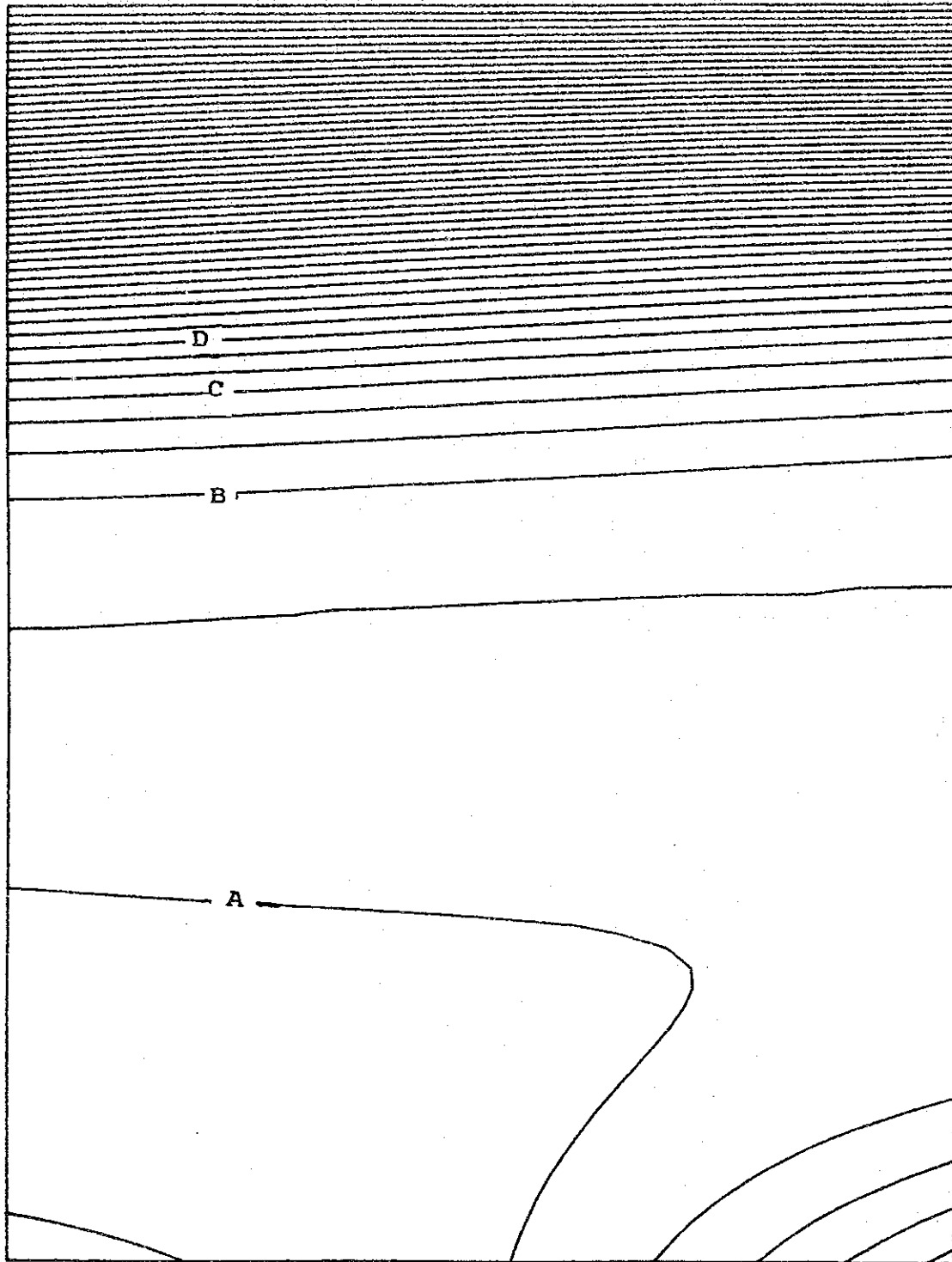


Fig. 3-12 Water Content Distribution after 120 hours of simulation



A = 1.0
B = 0.6
C = 0.2
D = -0.2

3. Subsidence Test in Peat Soil

3-1 Facilities and Measuring Instruments

For drainage from the test plot, the following facilities and instruments were provided.

Pump house 2m×5m	1 no.
3" pump and diesel engine	1 set
3" flow meter	1 no.

The pump and the flow meter were connected to three (3) inch PVC pipes.

In order to measure the subsidence and the hydrological and hydraulic conditions, the following instruments were provided.

Standard rain gauge	1 no.
Wet bulb and dry bulb thermometer	1 set
Staff gauge 2m	1 no.
Piezometer	7 nos.
Tensiometers	12 nos.
Iron Rod 3m	1 no.

The piezometers and the tensiometers were installed at four (4) places (see Fig.2-2). Two (2) piezometers were installed at each place except for the location D, and set at the depths of 100cm and 150cm from the ground level. The piezometer installed at the location D was set at the depth of 150cm.

Three (3) tensiometers were installed at each place and set at the depths of 10cm, 25cm and 60cm.

Along the cross section of the test plot, six (6) piezometers and nine (9) tensiometers were installed (see Fig. 4-1).

The iron rod was installed at the center of the test plot i.e. location B for measuring the subsidence and the swelling, and its lower end was set in the base subsoil layer.

3-2 Method of the subsidence test

Upon the subsidence test, the water level of the drainage canal is lowered by pumping near to the boundary between the peat layer and the marin clay layer, which is situated 1.7m below the ground level. The water movement in the peat layer is measured during the drainage period with

the piezometers and the tensiometers. The quantity of water drained from the peat layer can be calculated with those observed data. At the initial stage i.e. a few hours from the start time, the hydraulics vary rapidly and largely. So, the readings must be frequently performed.

The subsidence is observed with the iron rod installed at the center of the test plot, measuring the length from the upper end to the ground surface.

Before starting the test, the water level of the drainage canal must be kept at the ground level which is 1.73m of the staff gauge.

Concerning the long term observation, the subsidence and the swelling are measured daily together with the water level of the drainage canal. Soil sampling is conducted monthly at the depths of 10cm, 25cm and 60cm, and PH and EC of the samples are measured.

3-3 Progress of the subsidence test

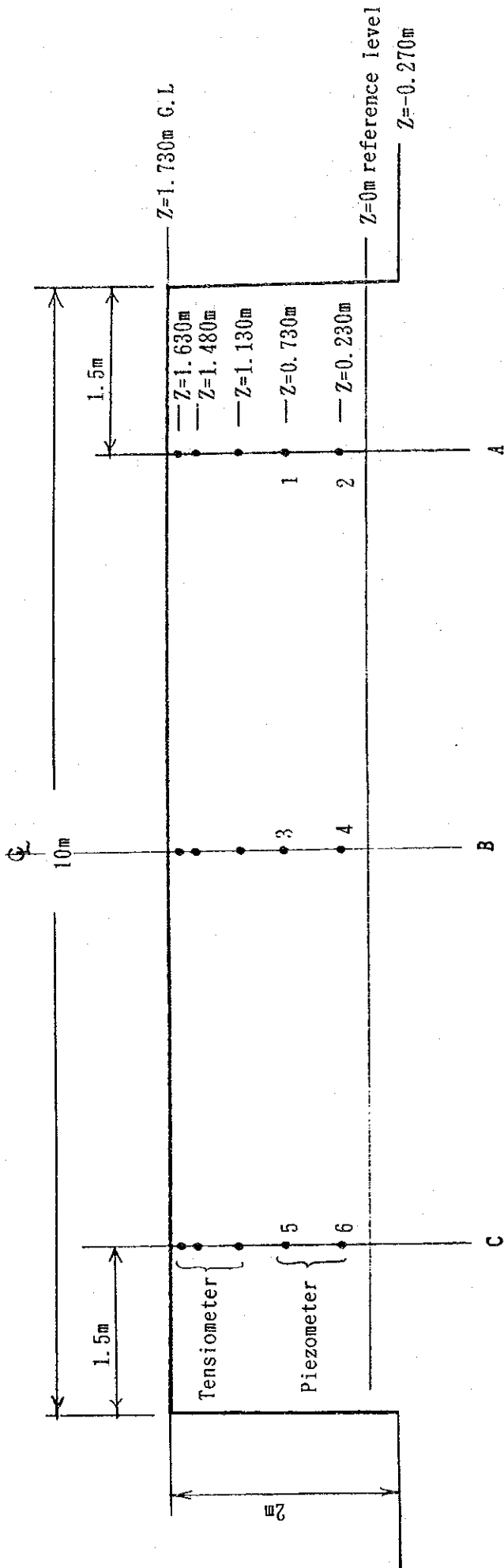
The subsidence test was conducted on Dec. 1st. It was fine and had no rain in the daytime. The pump started drainage at 10:50 and stopped at 16:30. During the period, the subsidence, the tensiometers, the piezometers and the staff gauge were read at the interval time of 20-40 minutes.

The drainage canal was full of water when the test started. It was able to lower the water level at about 1.2m below the ground level when the pump stopped. The subsidence was 16mm during the period, 23mm at 15:00 next day and 27mm on Dec. 8th (see Fig.4-2).

The variation of groundwater heads was significant in the layer situated deeper than 60cm below the surface when pumping. However, in the surface layer no variation of groundwater heads was observed. Therefore, there will be a significant difference in the hydraulic characteristics between the surface layer and the subsurface layer within the peat layer. The data obtained in this test were listed in Table 4-2 to Table 4-5.

Concerning the long term observation on the subsidence and the swelling, the observation started on Nov. 5th. Since then, it has been at the stage of swelling including the date of the subsidence test dated Dec. 1st. The

swelling was significant when there was a lot of rainfall, in particular, in the mid November and the late November. The swelling was observed at 30mm in the period until Dec. 1st. The data obtained by this long term observation were listed in Table 4-6 to Table 4-40.

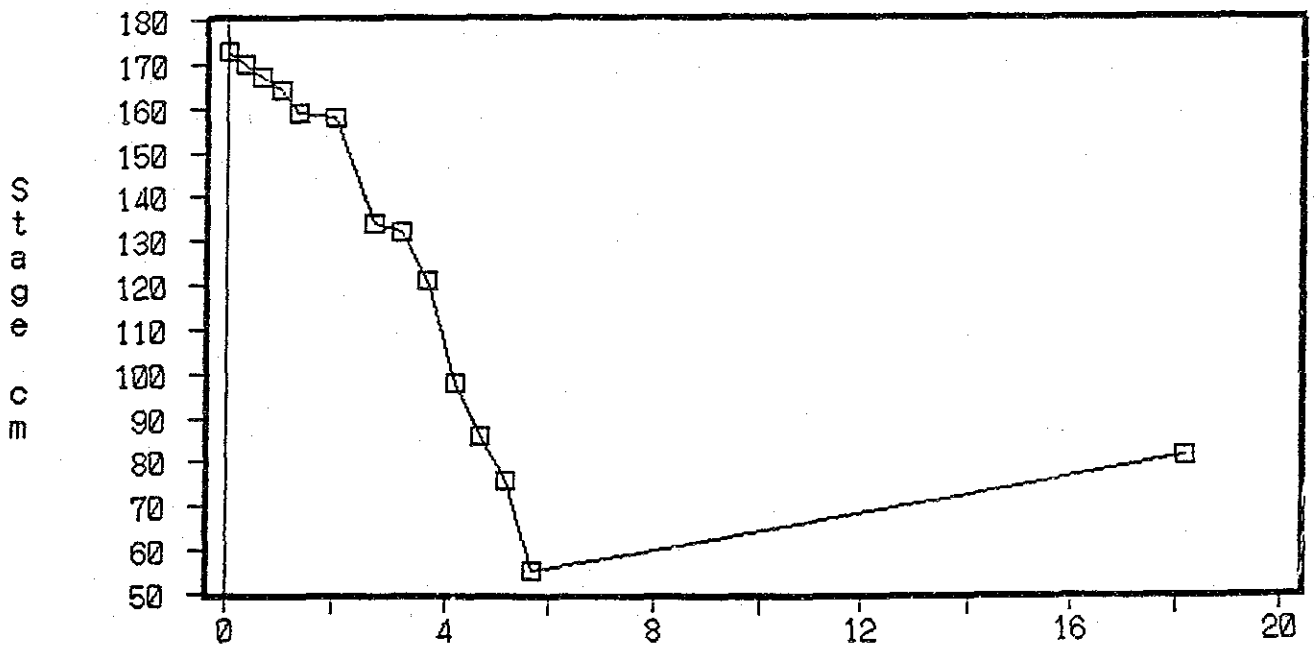
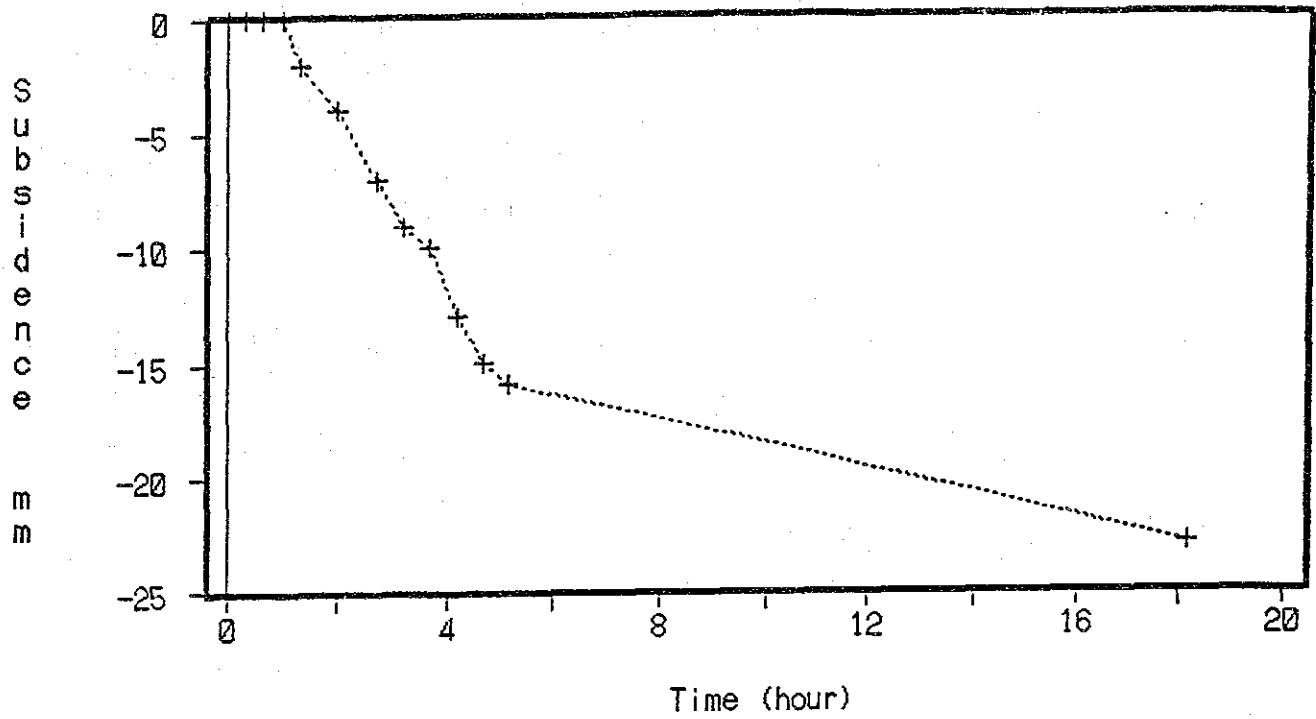


scale: 1:50

Figure 4-1 Cross Sectional Profile of the test plot in peat soil showing the positions of Tensiometers and Piezometers

The numbers are the piezometers indeces.
The alphabets are the location indeces.

Figure 4-2 Subsidence Test in the Bacho Swamp Test Plot.



Time (hour)
 + Subsidence □ Canal stage

3-4 Groundwater Simulation for Peat Soil, Bacho

3-4-1 Model Outline

The cross sectional area of the test plot shown in Fig. 4-1 was selected for simulation modeling. The saturated flow during the subsidence test was simulated. The test was conducted on December 1, 1992. Saturated groundwater flow simulation was employed, since unsaturated hydraulic conductivity of the peat soil were not available.

The model domain is divided into finite elements and the total elements and the nodes are 280 and 328 respectively. The initial conditions for the model is given by the total head of all nodes. The canal was full of water when the test started, and the total head was assumed at all nodes that there was no groundwater flow in the domain.

The following boundary conditions were adopted.

- a) Rainfall seepage at the top boundary
- b) Time varying prescribed canal heads at the right side and at the leftside of the model domain.
- c) No flow boundary at the bottom boundary nodes to represent the presence of marine clay.

The finite element mesh and the boundary conditions are shown in Fig.4-3.

The time step for the simulation is 10 minutes and the results are printed for every 10 minutes in order to compare with the observed data.

The hydraulic conductivity of the middle layer is not measured. Hence the simulation model has to be calibrated for different values of hydraulic conductivity.

3-4-2 Simulation Results

The primary result of the model was total head at all nodes at each time steps. The secondary results are velocity vector at the element centroids and water budgets.

The simulation was close to the observed data in the case that the hydraulic conductivity of the middle layer was $6.336E-4$ or $6.336E-5$. The simulated head at Location A, B and C were compared with the observed data and their comparison was shown in Fig.4-4, 4-5 and 4-6 respectively.

From those we are able to conclude that the model underpredicts during the earlier times and overpredicts during the latter part of the test. This transition takes place at the

middle layer, which is less permeable than the other two layers. The error is 8% between observed and simulated values.

The total head contour within the cross section after one two, three, four, and five hours of pumping were shown in Fig. 4-7, 4-8, 4-9, 4-10, and 4-11 respectively.

As a conclusion, it is possible to simulate the groundwater flow in the peat soil with the current model with a certain accuracy, if the peat soil is saturated.

Table: 4-1 Parameters given to the Saturated Groundwater Flow Model

	Layer 1	Layer 2	Layer 3
Soil Type	Peat	Peat	Peat
Thickness (cm)	25 cm	25 cm	120 cm
Permeability (cm/sec)	1.48×10^{-2}	6.34×10^{-3}	1.19×10^{-2}
Porosity (%)	25	20	25
Bulk density (gm/cc)	0.1	0.2	0.1

Fig. 4-3 Finite Element Mesh of the Model Domain

