Table VII-3 CALCULATION OF WATER DEPTH FOR UPLAND CROPS

Formula:

$$D = P \times Sa \times d \times \frac{1}{100}$$

Where,

D : water depth to be available for crop growth

P : fraction of available soil moisture for optimum crop growth
- for soybeans : 0.5
- for peanuts : 0.35

Sa : available soil moisture : $S_1 - S_2 = 14$ %
- average soil moisture at field capacity point (S_1) : 41 %
- average soil moisture at initial wilting point (S_2): 27 %

d : effective root depth
- for soybeans : 0.6 - 1.3 m
- for peanuts : 0.6 - 1.0 m

Calculation:

(1) for soybeans : $D = 0.5 \times 14 \times 1{,}000 \times \frac{1}{100}$

$= 70$ (mm)

(2) for peanuts : $D = 0.35 \times 14 \times 800 \times \frac{1}{100}$

$\doteq 40$ (mm)

Table VII-4(1) UNIT IRRIGATION WATER REQUIREMENTS

CROPPING PATTERN -1 (DRY SEASON PADDY)

	MAR. 1	MAR. 2	MAR. 3	APR. 1	APR. 2	APR. 3	MAY 1	MAY 2	MAY 3	JUNE 1	JUNE 2	JUNE 3	JULY 1	JULY 2	JULY 3	AUG. 1	AUG. 2	AUG. 3
CROP INT.						0.11	0.33	0.56	0.78	1.00	1.00	1.00	0.97	0.78	0.56	0.33	0.11	
KC VALUE						0.99	0.95	1.14	1.30	1.34	1.30	1.15	0.88	0.76	0.	0.	0.	
KC VALUE						0.	0.99	0.95	1.14	1.30	1.34	1.30	1.15	0.88	0.76	0.	0.	
KC VALUE						0.	0.	0.99	0.95	1.14	1.30	1.34	1.30	1.15	0.88	0.76	0.	
KC VALUE						0.	0.	0.	0.99	0.95	1.14	1.30	1.34	1.30	1.15	0.88	0.76	
AVERAGE KC						0.99	0.97	1.03	1.09	1.18	1.27	1.27	1.17	1.02	0.93	0.82	0.76	
EVAPO-TRANS (mm)						49.	47.	47.	52.	42.	42.	42.	44.	44.	48.	49.	49.	
CONSUMP.USE (mm)						49.	46.	48.	57.	50.	55.	53.	51.	45.	45.	40.	37.	
PERC. LOSS (mm)						10.	10.	10.	11.	20.	20.	20.	20.	20.	22.	20.	20.	
EFFECT.RAIN (mm)						21.	25.	29.	20.	12.	7.	10.	4.	6.	9.	6.	5.	
SUB-TOTAL (mm)						4.	10.	16.	37.	58.	67.	63.	65.	46.	33.	18.	6.	
NURSARY W. (mm)	1.	2.	3.	4.	3.	1.	1.											
PUDDLING W. (mm)	0.	0.	34.	33.	33.	33.	17.											
FARM REQ. (mm)	1.	2.	37.	41.	46.	50.	55.	58.	67.	63.	65.	46.	33.	18.	6.			
IRR. REQ. (mm)	2.	5.	62.	68.	77.	84.	92.	97.	111.	106.	108.	77.	54.	30.	10.			
UNIT W.REQ. (l/sec/ha)	0.02	0.04	0.71	0.79	0.89	0.97	1.07	1.12	1.28	1.22	1.25	0.89	0.63	0.34	0.11			

Table V11-4 (2) UNIT IRRIGATION WATER REQUIREMENTS

CROPPING PATTERN -1 (RAINY SEASON PADDY)

	NOV. 1	NOV. 2	NOV. 3	DEC. 1	DEC. 2	DEC. 3	JAN. 1	JAN. 2	JAN. 3	FEB. 1	FEB. 2	FEB. 3	MAR. 1	MAR. 2	MAR. 3
CROP INT.				0.13	0.38	0.63	0.88	1.00	1.00	1.00	1.00	0.88	0.63	0.38	0.13
KC VALUE				0.81	0.96	1.15	1.28	1.35	1.33	1.22	0.96	0.76	0.	0.	0.
KC VALUE				0.	0.81	0.96	1.15	1.28	1.35	1.33	1.22	0.96	0.76	0.	0.
KC VALUE				0.	0.	0.81	0.96	1.15	1.28	1.35	1.33	1.22	0.96	0.76	0.
KC VALUE				0.	0.	0.	0.81	0.96	1.15	1.28	1.35	1.33	1.22	0.96	0.76
AVERAGE KC				0.81	0.89	0.97	1.05	1.19	1.28	1.30	1.22	1.07	0.98	0.84	0.76
EVAPO-TRANS (mm)				45.	45.	50.	45.	45.	50.	43.	43.	34.	51.	51.	56.
PERC. LOSS (mm)				36.	40.	48.	47.	53.	63.	56.	52.	37.	50.	44.	43.
PERC. LOSS (mm)				10.	10.	11.	10.	10.	11.	10.	10.	8.	10.	10.	11.
EFFECT.RAIN (mm)				31.	45.	41.	54.	34.	34.	21.	29.	19.	23.	27.	22.
SUB-TOTAL (mm)				2.	2.	11.	21.	29.	40.	44.	54.	23.	23.	10.	4.
NURSARY W. (mm)	1.	3.	5.	4.	3.	1.	0.								
PUDDLING W. (mm)	0.	0.	38.	37.	37.	38.	0.								
FARM REQ. (mm)	1.	3.	41.	43.	42.	50.	21.	29.	40.	44.	34.	23.	23.	10.	4.
IRR. REQ. (mm)	2.	5.	68.	72.	70.	84.	34.	48.	67.	74.	56.	38.	39.	17.	7.
UNIT W.REQ. (l/sec/ha)	0.02	0.06	0.79	0.83	0.81	0.97	0.40	0.56	0.78	0.85	0.65	0.44	0.45	0.19	0.08

Table V11-4(3) UNIT IRRIGATION WATER REQUIREMENTS

CROPPING PATTERN -1 (PEANUTS)

	AUG. 2	AUG. 3	SEP. 1	SEP. 2	SEP. 3	OCT. 1	OCT. 2	OCT. 3	NOV. 1	NOV. 2	NOV. 3	DEC. 1	DEC. 2	DEC. 3
CROP INT.	0.05	0.40	0.80	1.00	1.00	1.00	1.00	1.00	1.00	0.98	0.60	0.20		
KC VALUE	0.29	0.35	0.46	0.70	0.92	0.97	0.95	0.88	0.73	0.55	0.	0.		
KC VALUE	0.	0.29	0.53	0.44	0.70	0.92	0.97	0.95	0.88	0.73	0.55	0.		
KC VALUE	0.	0.	0.29	0.35	0.46	0.70	0.92	0.97	0.95	0.88	0.73	0.55		
AVERAGE KC	0.29	0.31	0.36	0.50	0.69	0.86	0.95	0.93	0.85	0.72	0.64	0.55		
EVAPO-TRANS (mm)	25.	54.	49.	49.	49.	49.	49.	54.	46.	46.	46.	45.		
CONSMPT.USE (mm)	7.	17.	18.	24.	34.	42.	46.	50.	39.	33.	29.	25.		
EFFECT.RAIN (mm)	1.	4.	7.	6.	7.	9.	9.	13.	27.	22.	23.	16.		
SUB-TOTAL (mm)	0.	5.	9.	18.	27.	33.	37.	38.	12.	11.	4.	7.		
FARM REQ.W. (mm)	0.	7.	12.	24.	36.	45.	50.	50.	16.	14.	6.	2.		
IRR.W.REQ. (mm)	1.	11.	20.	40.	60.	74.	83.	84.	26.	24.	9.	4.		
UNIT IRR.W. (l/sec/ha)	0.01	0.13	0.23	0.46	0.69	0.86	0.96	0.97	0.30	0.28	0.11	0.05		

Table VII-4 (4) UNIT IRRIGATION WATER REQUIREMENTS

CROPPING PATTERN – 2 (DRY SEASON PADDY)

	MAR. 2	3	APR. 1	2	3	MAY 1	2	3	JUNE 1	2	3	JULY 1	2	3	AUG. 1	2	3
CROP INT.				0.11	0.33	0.56	0.78	0.97	1.00	1.00	0.89	0.67	0.44	0.22	0.03		
KC VALUE				0.82	1.00	1.20	1.33	1.33	1.26	0.98	0.76	0.	0.	0.	0.		
KC VALUE				0.	0.82	1.00	1.20	1.33	1.33	1.26	0.98	0.76	0.	0.	0.		
KC VALUE				0.	0.	0.82	1.00	1.20	1.33	1.33	1.26	0.98	0.76	0.	0.		
KC VALUE				0.	0.	0.	0.82	1.00	1.20	1.33	1.33	1.26	0.98	0.76	0.		
KC VALUE				0.	0.	0.	0.	0.82	1.00	1.20	1.33	1.33	1.26	0.98	0.76		
AVERAGE KC				0.82	0.91	1.01	1.09	1.14	1.22	1.22	1.13	1.08	1.00	0.87	0.76		
EVAPO-TRANS (mm)				49.	47.	47.	52.	42.	42.	42.	44.	44.	48.	49.	25.		
CONSUMP.USE (mm)				40.	43.	47.	56.	48.	51.	51.	50.	48.	48.	43.	19.		
PERC. LOSS (mm)				20.	20.	20.	22.	40.	40.	40.	40.	40.	44.	40.	20.		
EFFECT.RAIN (mm)				22.	26.	28.	22.	10.	7.	11.	5.	7.	11.	7.	3.		
SUB-TOTAL (mm)				4.	12.	22.	44.	76.	85.	80.	75.	54.	36.	17.	1.		
NURSARY W. (mm)	1.	2.	3.	4.	4.	2.	1.										
PUDDLING W. (mm)	0.	0.	34.	33.	33.	33.	17.										
FARM REQ. (mm)	1.	2.	37.	41.	49.	57.	62.	76.	85.	80.	75.	54.	36.	17.	1.		
IRR. REQ. (mm)	2.	3.	42.	69.	82.	95.	103.	126.	141.	133.	125.	90.	60.	28.	2.		
UNIT W.REQ. (l/sec./ha)	0.02	0.04	0.71	0.80	0.95	1.10	1.20	1.46	1.64	1.54	1.45	1.04	0.69	0.32	0.02		

Table V11-4 (5) UNIT IRRIGATION WATER REQUIREMENTS

CROPPING PATTERN -2 (RAINY SEASON PADDY)

	NOV. 1	NOV. 2	NOV. 3	DEC. 1	DEC. 2	DEC. 3	JAN. 1	JAN. 2	JAN. 3	FEB. 1	FEB. 2	FEB. 3	MAR. 1	MAR. 2	MAR. 3	APR. 1	APR. 2	APR. 3
CROP INT.				0.08	0.25	0.42	0.58	0.75	0.92	1.00	1.00	0.92	0.75	0.58	0.42	0.25	0.08	
KC VALUE				0.81	0.96	1.15	1.28	1.35	1.35	1.22	0.96	0.76	0.	0.	0.	0.	0.	
KC VALUE				0.	0.81	0.96	1.15	1.28	1.35	1.33	1.22	0.96	0.76	0.	0.	0.	0.	
KC VALUE				0.	0.	0.81	0.96	1.15	1.28	1.35	1.33	1.22	0.96	0.76	0.	0.	0.	
KC VALUE				0.	0.	0.	0.81	0.96	1.15	1.28	1.35	1.33	1.22	0.96	0.76	0.	0.	
KC VALUE				0.	0.	0.	0.	0.81	0.96	1.15	1.28	1.35	1.33	1.22	0.96	0.76	0.	
KC VALUE				0.	0.	0.	0.	0.	0.81	0.96	1.15	1.28	1.35	1.33	1.22	0.96	0.76	
AVERAGE KC				0.81	0.89	0.97	1.05	1.11	1.15	1.22	1.22	1.15	1.12	1.07	0.98	0.86	0.76	
EVAPO-TRANS (mm)				45.	45.	50.	45.	45.	50.	43.	43.	34.	51.	51.	56.	49.	49.	
PERC. LOSS (mm)				36.	40.	48.	47.	50.	57.	52.	52.	40.	57.	54.	55.	42.	37.	
PERC. LOSS (mm)				20.	20.	22.	20.	20.	22.	20.	20.	16.	20.	20.	22.	20.	20.	
EFFECT.RAIN (mm)				55.	49.	44.	39.	33.	31.	22.	31.	21.	24.	29.	27.	32.	25.	
SUB-TOTAL (mm)				2.	3.	11.	14.	28.	44.	50.	41.	32.	40.	26.	21.	7.	3.	
NURSARY W. (mm)	1.	2.	2.	1.	3.	3.	2.	1.	0.									
PUDDLING W. (mm)	0.	0.	25.	25.	25.	25.	25.	25.	0.									
FARM REQ. (mm)	1.	2.	27.	30.	51.	39.	43.	54.	44.	50.	41.	32.	40.	26.	21.	7.	3.	
IRR. REQ. (mm)	2.	3.	45.	49.	81.	65.	72.	90.	73.	84.	68.	53.	66.	44.	35.	12.	4.	
UNIT W.REQ. (l/sec/ha)	0.02	0.04	0.52	0.57	0.59	0.75	0.83	1.04	0.85	0.97	0.79	0.61	0.77	0.51	0.40	0.14	0.05	

Table V11-4(6) UNIT IRRIGATION WATER REQUIREMENTS

CROPPING PATTERN -2 (POLOWIJO, DRY SEASON, SOYBEAN)

	JUNE 1	JUNE 2	JUNE 3	JULY 1	JULY 2	JULY 3	AUG. 1	AUG. 2	AUG. 3	SEP. 1	SEP. 2	SEP. 3	OCT. 1	OCT. 2	OCT. 3
CROP INT.	0.04	0.33	0.67	0.87	1.00	1.00	1.00	1.00	1.00	1.00	0.87	0.67	0.33	0.04	
KC VALUE	0.19	0.25	0.33	0.41	0.55	0.72	0.91	1.04	0.93	0.76	0.68	0.60	0.	0.	
KC VALUE	0.	0.19	0.25	0.33	0.41	0.55	0.72	0.91	1.04	0.93	0.76	0.68	0.60	0.	
KC VALUE	0.	0.	0.19	0.25	0.33	0.41	0.55	0.72	0.91	1.04	0.93	0.76	0.68	0.60	
AVERAGE KC	0.19	0.22	0.26	0.33	0.43	0.56	0.73	0.89	0.96	0.91	0.79	0.68	0.64	0.60	
EVAPO-TRANS (mm)	21.	42.	42.	44.	44.	48.	49.	49.	54.	49.	49.	49.	49.	25.	
CONSUMP.USE (mm)	4.	9.	11.	15.	19.	27.	36.	44.	52.	45.	39.	33.	31.	15.	
EFFECT.RAIN (mm)	1.	4.	7.	4.	8.	11.	7.	6.	6.	8.	9.	7.	6.	4.	
SUB-TOTAL (mm)	0.	2.	2.	9.	11.	16.	29.	37.	46.	36.	26.	18.	8.	0.	
FARM REQ.W. (mm)	0.	2.	3.	12.	15.	21.	39.	50.	61.	49.	34.	23.	11.	1.	
IRR. W.REQ. (mm)	0.	4.	5.	20.	25.	35.	65.	83.	102.	81.	57.	39.	19.	1.	
UNIT.IRR.W. (l/sec/ha)	0.00	0.05	0.06	0.24	0.29	0.40	0.75	0.96	1.18	0.94	0.66	0.45	0.22	0.01	

Table VII-5 SUMMARY OF UNIT IRRIGATION WATER REQUIREMENTS

Description	Cropped Area (%)	JAN. 1	JAN. 2	JAN. 3	FEB. 1	FEB. 2	FEB. 3	MAR. 1	MAR. 2	MAR. 3	APR. 1	APR. 2	APR. 3	MAY 1	MAY 2	MAY 3	JUNE 1	JUNE 2	JUNE 3
A. Cropping Pattern Type-I (for 1.0 ha area)																			
- Rainy season paddy (lit/sec/ha)	100	0.40	0.56	0.78	0.85	0.65	0.44	0.45	0.19	0.08									
- Dry season paddy (lit/sec/ha)	100									0.02	0.04	0.71	0.79	0.89	0.97	1.07	1.12	1.28	1.22
- Peanuts (lit/sec/ha)	50																		
TOTAL (lit/sec/ha)		0.40	0.56	0.78	0.85	0.65	0.44	0.45	0.19	0.10	0.04	0.71	0.79	0.89	0.97	1.07	1.12	1.28	1.22
B. Cropping Pattern Type-II (for 1.5 ha area)																			
- Rainy season paddy (lit/sec/ha)	100	0.83	1.04	0.85	0.97	0.79	0.61	0.77	0.51	0.40	0.14	0.05							
- Dry season paddy (lit/sec/ha)	67									0.01	0.03	0.48	0.54	0.64	0.74	0.80	0.98	1.10	1.03
- Soybeans (lit/sec/ha)	33																0	0.02	0.02
TOTAL (lit/sec/ha)		0.83	1.04	0.85	0.97	0.79	0.61	0.77	0.51	0.41	0.17	0.53	0.54	0.64	0.74	0.80	0.98	1.12	1.05
C. Cropping Pattern Type-III /1 (for 2.0 ha area) (lit/sec/ha)		0.62	0.32	0.43	0.66	0.69	0.62	0.50	0.39	0.33	0.28	0.57	0.59	0.67	0.75	0.77	1.28	1.08	1.18

Description	Cropped Area (%)	JULY 1	JULY 2	JULY 3	AUG. 1	AUG. 2	AUG. 3	SEPT. 1	SEPT. 2	SEPT. 3	OCT. 1	OCT. 2	OCT. 3	NOV. 1	NOV. 2	NOV. 3	DEC. 1	DEC. 2	DEC. 3
A. Cropping Pattern Type-I (for 1.0 ha area)																			
- Rainy season paddy (lit/sec/ha)	100													0.02	0.06	0.79	0.83	0.81	0.97
- Dry season paddy (lit/sec/ha)	100	1.25	0.89	0.61	0.34	0.11													
- Peanuts (lit/sec/ha)	50					0.01	0.06	0.12	0.23	0.35	0.43	0.48	0.49	0.15	0.14	0.06	0.03		
TOTAL (lit/sec/ha)		1.25	0.89	0.63	0.34	0.12	0.06	0.12	0.23	0.35	0.43	0.48	0.49	0.17	0.20	0.85	0.86	0.81	0.97
B. Cropping Pattern Type-II (for 1.5 ha area)																			
- Rainy season paddy (lit/sec/ha)	100													0.02	0.04	0.52	0.57	0.59	0.75
- Dry season paddy (lit/sec/ha)	67	0.97	0.70	0.46	0.21	0.01													
- Soybeans (lit/sec/ha)	33	0.08	0.10	0.13	0.25	0.32	0.39	0.31	0.22	0.15	0.07	0							
TOTAL (lit/sec/ha)		1.05	0.80	0.59	0.46	0.33	0.19	0.31	0.22	0.15	0.07	0	0	0.02	0.04	0.52	0.57	0.59	0.75
C. Cropping Pattern Type-III /1 (for 2.0 ha area) (lit/sec/ha)		1.20	1.05	0.86	0.67	0.45	0.24	0.05	0	0	0	0	0	0	0.02	0.39	0.43	0.50	0.53

/1: This figure is extracted from the Comprehensive Study Report prepared by JICA in 1980 for the use of alternative study on the headworks site.

Table VII-6 CALCULATION OF DESIGN DRAINAGE DISCHARGE FOR MAIN DRAIN

Rational method : $Q = 0.2778 \times f \times r_t \times A$

Where, Q = stream runoff (m^3/sec)

f = runoff coefficient (0.5)

r_t = hourly rainfall (mm/hour); $\frac{r_{24}}{24} \cdot (\frac{24}{Tc})^{0.5}$

r_{24}= 24 hours rainfall (mm/day)
= 120 mm

Tc = Lag time (hr); L/W

$W = 72 (\frac{h}{L})^{0.6}$

h = height difference between upper-most point and computation point of stream

L = stream distance (m or km)

A = catchment area (km^2)

Station	L (km)	A (km^2)	h (m)	W (km/hr)	Tc (hr)	r_t (mm/hr)	Q (m^3/sec)
Belitang Main Drain							
BS-0	2.5	11.5	-	-	-	-	9 /1
BS-1	10.9	31.8	-	-	-	-	24 /1
BS-2	15.1	43.3	-	-	-	-	32 /1
BS-3	18.7	52.6	-	-	-	-	39 /1
BS-4	25.9	120.9	19.2	0.95	27.2	4.9	83
BS-5	27.7	145.9	20.9	0.96	28.7	4.8	97
BS-6	31.9	165.7	23.0	0.94	31.0	4.3	98
BS-7	43.9	205.5	29.6	0.90	48.7	3.4	96
BS-8	51.1	243.7	33.4	0.88	57.8	3.0	101
BS-9	61.9	261.2	37.5	0.84	73.3	2.6	93 (101) /2
BS-10	81.1	328.7	47.8	0.83	97.6	2.1	96 (101) /2
BS-11	97.9	361.0	53.4	0.79	123.4	1.8	90 (101) /2

(to be continued)

Station	L (km)	A (km^2)	h (m)	W (km/hr)	Tc (hr)	r_t (mm/hr)	Q (m^3/sec)
Macak Main Drain							
MS-0	4.0	10.8	-	-	-	-	8 /1
MS-1	13.6	58.3	-	-	-	-	44 /1
MS-2	22.6	86.3	-	-	-	-	65 /1
MS-3	34.6	179.1	27.8	1.00	34.6	4.2	105
MS-4	50.2	255.6	34.9	0.92	54.7	3.1	110
MS-5	67.0	328.1	43.2	0.88	76.4	2.5	113
MS-6	76.0	373.6	46.1	0.85	89.9	2.2	116
MS-7	88.0	406.9	51.5	0.83	106.4	2.0	113 (116) /2

/1: These figures are computed by:

Q = Area x 7.5 l/sec/ha

/2: Design discharge at each station.

Table VII-7 CONSTRUCTION COSTS OF ALTERNATIVE CASES FOR HEADWORKS

Site & Alternative Intake Water Level	Length of Driving channel	Construction Cost (Unit: 10^3 US$)				
		Weir	Intake	Driving Channel	Desilting Basin	Total
Pracak Site						
Case-1 : 86.60 m	500	8,921	1,950	876 /1	1,981	13,728
Case-2 : 85.60 m	2,800	6,185	1,950	3,566	2,040	13,741
Case-3 : 84.60 m	2,800	4,389	1,950	4,170	2,161	12,670
Porjova Site						
Case-1 : 81.30 m	1,600	12,804	1,900	1,056	1,632	17,392
Case-2 : 80.30 m	1,600	10,409	1,900	1,188	1,836	15,333
Case-3 : 79.30 m	1,600	8,710	1,900	1,320	2,040	13,970
Case-4 : 78.30 m	1,600	7,581	1,900	1,584	2,245	13,310

Note: /1: due to the high intake water level, the settling basin can be shifted near the headworks so that the length of a driving channel be reduced.

Table VII-8(1) COMPARISON OF CONSTRUCTION COSTS OF ALTERNATIVE CASES (PRACAK SITE)

Alternative Case (Intake WL)	Construction Cost				Annual /1 Equivalent Cost	Annual O & M Cost	Irrigable Area	Annual Cost per Hectare
	Headworks	Headreach		Total				
	(10^3US$)		(10^3US$)	(10^3US$)	(10^3US$)	(10^3US$)	(ha)	(US$/ha)
Case - 1 (86.60 m)	13,728	(1) Earth	: 1/ 8,000: 34,469	48,197	3,940	241	37,900	110.3
			: 1/10,000: 44,492	58,220	4,759	291	38,000	132.9
		(2) Concrete	: 1/ 2,000: 14,143	27,871	2,360	84	37,500	65.2
			: 1/ 6,000: 33,526	47,254	3,863	142	37,800	107.1
			: 1/10,000: 44,789	58,517	4,783	176	38,000	130.5
Case - 2 (85.60 m)	13,741	(1) Earth	: 1/ 8,000: 12,179	25,920	2,119	130	37,700	59.7
			: 1/10,000: 13,363	27,104	2,215	134	37,800	62.1
		(2) Concrete	: 1/ 2,000: 11,203	24,944	2,039	75	37,400	56.5
			: 1/ 6,000: 13,974	27,715	2,265	83	37,700	62.3
			: 1/10,000: 15,646	29,387	2,402	88	37,800	65.9
Case - 3 (84.60 m)	12,670	(1) Earth	: 1/ 8,000: 12,061	24,731	2,022	124	37,600	57.1
			: 1/10,000: 12,979	25,649	2,097	128	37,700	59.0
		(2) Concrete	: 1/ 2,000: 12,322	24,992	2,043	75	37,200	56.9
			: 1/ 6,000: 13,730	26,400	2,158	79	37,600	59.5
			: 1/10,000: 15,117	27,787	2,271	83	37,700	62.4

/1 : calculated based on economic life of 50 years and interest rate of 8% (Capital Recovery Factor: 0.08174)

Table VII-8(2) COMPARISON OF CONSTRUCTION COSTS OF ALTERNATIVE CASES (PERJAYA SITE)

Alternative Case (Intake WL)	Construction Cost					Annual /1 Equivalent Cost (10^3US$)	Annual O & M Cost (10^3US$)	Irrigable Area (ha)	Annual Cost per Hectare (US$/ha)
	Headworks (10^3US$)	Headreach (10^3US$)			Total (10^3US$)				
Case - 1 (81.30 m)	17,392	(1) Earth	: 1/ 8,000:	3,094	20,486	1,675	102	37,100	47.9
			: 1/10,000:	3,314	20,706	1,693	104	37,100	48.4
		(2) Concrete	: 1/ 2,000:	3,606	20,998	1,716	63	36,900	48.2
			: 1/ 6,000:	4,379	21,771	1,780	65	37,100	49.7
			: 1/10,000:	4,818	22,210	1,815	67	37,100	50.7
Case - 2 (80.30 m)	15,333	(1) Earth	: 1/ 8,000:	3,059	18,392	1,503	92	36,900	43.2
			: 1/10,000:	3,275	18,608	1,521	93	37,000	43.6
		(2) Concrete	: 1/ 2,000:	3,910	19,243	1,573	58	36,800	43.1
			: 1/ 6,000:	4,247	19,580	1,600	59	36,900	45.0
			: 1/10,000:	4,647	19,979	1,633	60	37,000	45.8
Case - 3 (79.30 m)	13,970	(1) Earth	: 1/ 8,000:	3,470	17,440	1,426	87	36,700	41.2
			: 1/10,000:	4,164	18,134	1,482	91	36,900	42.6
		(2) Concrete	: 1/ 3,000:	4,370	18,340	1,499	55	36,500	42.6
			: 1/ 6,000:	4,629	18,599	1,520	56	36,600	43.1
			: 1/10,000:	5,023	18,993	1,552	57	36,900	43.6
Case - 4 (78.30 m)	13,310	(1) Earth	: 1/ 8,000:	3,984	17,294	1,414	86	36,400	41.2
			: 1/10,000:	4,190	17,500	1,430	88	36,700	41.4
		(2) Concrete	: 1/ 4,000:	4,908	18,218	1,489	55	36,300	42.5
			: 1/ 7,000:	5,148	18,458	1,509	55	36,400	43.0
			: 1/10,000:	5,350	18,660	1,525	56	36,700	43.1

/1 : calculated based on economic life of 50 years and interest rate of 8% (Capital Recovery Factor; 0.08174)

Table VII-9 COST ESTIMATE OF JOINT CONSTRUCTION AND FUTURE EXPANSION OF HEADWORKS AND RELATED FACILITIES FOR LEMPUING PROJECT

Case-1: Construction of Related Facilities with Increased Capacity for Lempuing Area

1. Allocated Construction Cost/1		Amount (US$)
(1) Headworks		2,080,000
(2) Headreach		700,000
(3) North main canal		3,510,000
	Total	6,290,000
2. Annual Allocated O & M Cost/2		31,500

Case-2: Capacity Expansion of Main Facilities for Lempuing Area in Future Stage

1. Construction Cost of Extension Works		Amount (US$)
(1) Headworks		3,180,000
(2) Headreach		1,530,000
(3) North main canal		7,225,000
	Total	11,935,000
2. Annual O & M Cost/2		59,680

Note: /1; The cost allocation of the joint facilities is made by reducing the construction cost for Komering-1 Project from the total construction cost in case that the Lempuing Project and the Komering Project are implemented at the same time.

/2; Annual O & M cost is estimated to be 0.5% of the initial investment.

Table VII-10 COST ESTIMATE OF JOINT CONSTRUCTION AND FUTURE EXPANSION OF HEADWORKS AND RELATED FACILITIES FOR TULANGBAWANG PROJECT

Case-1: Construction of Main Facilities with Increased Capacity for Tulangbawang Area

1. Allocated Construction Cost/1		Amount (US$)
(1) Headworks		7,180,000
(2) Headreach		2,720,000
(3) South main canal		2,415,000
	Total	12,315,000
2. Annual Allocated O & M Cost/2		61,580

Case-2: Capacity Expansion of Main Facilities for Tulangbawang Area in Future Stage

1. Construction Cost of Extension Works		Amount (US$)
(1) Headworks		11,310,000
(2) Headreach		5,400,000
(3) South main canal		4,360,000
	Total	21,070,000
2. Annual O & M Cost/2		105,300

Note: /1; The cost allocation of the joint facilities is made by reducing the construction cost for the Komering-I Project from the total construction cost in case that the Tulangbawang Project and the Komering-I Project are implemented at the same time.

/2; Annual O & M cost is estimated to be 0.5% of the initial investment.

Table VII-11 COST COMPARISON ON INTEGRATION OF INTAKE OF BELITANG PROPER AREA

(Unit: US$)

A.	**Cost Estimate**	
	Case-1: (Diversion from Kurungan Nyawa existing intake)	
	1. Construction cost of related facility	315,000
	- Aqueduct on north main canal for crossing of the Belitang Irrigation Canal	315,000
	2. Annual O & M Cost	117,020
	(1) Crossing structure /1	1,580
	(2) Dredging of the Belitang Irrigation Canal /2	115,440
	Case-2: (Diversion from Komering-I canal system)	
	1. Construction cost of related facilities	3,888,000
	(1) Diversion structure on north main canal for proper area	169,000
	(2) Closing and crossing structure of the Belitang Irrigation Canal	49,000
	(3) Allocated cost of Komering-I canal system	3,670,000
	(i) Headworks (2,470,000)	
	(ii) Headreach (1,100,000)	
	(iii) North main canal (100,000)	
	2. Annual O & M Cost /1	19,440
	(1) Crossing and diversion structures	1,090
	(2) Allocated cost of Komering-I canal system	18,350
B.	**Annual Cost**	
	Case-1	
	(1) Incremental capital recovery cost of crossing structure /3	25,750
	(2) Annual O & M Cost	117,020
	Total	142,770
	Case-2	
	(1) Capital recovery cost of allocated cost /4	317,810
	(2) Annual O & M Cost	19,440
	Total	337,250

Note: /1; Annual O & M Cost is estimated to be 0.5% of the initial investment.

/2; Annual dredging cost is based on the following:
Annual sediment volume : 104,000 m^3/year
Unit price of dreding work: 1.11 US$/$m^3$

/3; Difference in capital recovery cost of crossing structures between Case-1 and Case-2, calculated basing on economic life of 50 years and interest rate of 8% (Capital Recovery Factor, C.R.F. = 0.08174)

/4; Using C.R.F. of 0.08174

Table VII-12 COST COMPARISON ON INTEGRATION OF INTAKE OF MUNCAK KABAU PROJECT

(Unit: US$)

A. Cost Estimate		
Case-1: (Water Diversion through indipendent intake near Muncak Kabau)		
1. Construction cost of related facilities		791,430
(1) Muncak Kabau intake		267,070
(2) Desilting basin		308,360
(3) Headreach (Connecting channel)		216,000
2. Annual O & M Cost		78,860
(1) Intake, desilting basin and headreach /1		3,960
(2) Dredging of desilting basin /2		74,900
Case-2: (Diversion from Komering-I System)		
1. Allocated construction cost		2,231,000
(1) Headworks		1,570,000
(2) Headreach		560,000
(3) North main canal		101,000
2. Construction cost of connecting canal from North Main Canal to Muncak Kabau area		1,964,000
3. Annual O & M Cost /2		20,980
(1) Annual allocated O & M Cost		11,160
(2) Annual O & M Cost of connecting canal		9,820
B. Annual Cost		
Case-1		
(1) Capital recoverying cost of intake facility /3		64,690
(2) Annual O & M Cost		78,860
	Total	143,550
Case-2		
(1) Capital recovery cost of allocated cost and construction cost of connecting canal /3		342,900
(2) Annual O & M Cost		20,980
	Total	363,880

Note: /1; Annual O & M Cost is estimated to be 0.5% of the initial investment.

/2; Annual dreding cost is estimated based on the following:
Annual sediment volume : 67,500 m^3/year
Unit price of dreding works: 1.11 US$/$m^3$

/3; Based on the economic life of 50 years and interest rate of 8% (C.R.F. = 0.08174).

Table VII-13 (1) GENERAL FEATURES OF PROJECT FACILITIES

Name of Scheme	:	Komering-I Irrigation Development Project in the Upper Komering River Basin
Source of Irrigation Water	:	Komering river
Net Irrigable Area	:	36,700 ha
Maximum Diversion Water Requirement	:	44.1 m^3/sec
1. Ranau Regulating Dam		
(1) Location	:	Selabung river, 2.3 km downstream from the outlet of Lake Ranau
(2) Design water level		
- High water level	:	HWL 543.0 m
- Low water level	:	LWL 539.0 m
(3) Effective operation depth of Lake Ranau	:	2.5 m
(4) Maximum regulating discharge	:	50 m^3/sec
(5) Concrete dam portion		
- Type of dam	:	concrete gravity dam
- Crest elevation	:	EL. 544.0 m
- Length of crest	:	84.0 m
(6) Gated weir portion		
- Type of weir	:	overflow type
- Size of gate (B x H)	:	2.5 m x 1.6 m, 6 sets
- Gate operation	:	operated by manual
(7) Stilling basin		
- Length	:	25.0 m
(8) Expansion of river		
- Type of channel	:	trapezoidal
- Base width	:	18.0 m
- Side slope of channel	:	1:0.2
- Length	:	2.9 km

(to be continued)

Table VII-13 (2) GENERAL FEATURES OF PROJECT FACILITIES

2. Headworks		
(1) Location	:	Komering river, 3 km downstream from Martapura
(2) Intake water level	:	EL. 79.30 m
(3) Design flood water level	:	EL. 81.80 m
(4) Fixed weir		
- Crest elevation	:	EL. 79.30 m
- Length	:	171 m
(5) Movable weir		
- Type of gate	:	roller gate
- Size of gate (B x H)	:	17.5 m x 5.4 m, 2 sets
- Gate operation	:	operated by motor
(6) Raft way, width	:	8 m
(7) Intake structure		
- Size of gate (B x H)	:	7.0 m x 4.0 m, 3 sets
- Gate operation	:	operated by motor and manual, combinedly
(8) Driving channel		
- Type of canal	:	trapezoidal
- Lining material	:	concrete
- Base width	:	5.0 m
- Side slope of canal	:	1:1.5
- Length	:	1.6 km
(9) Settling basin		
- Type of desilting	:	gravitationally flushing-out
- Width of basin	:	40 m
- Length of basin	:	35 m
- No. of basin	:	2 nos.
- No. of gate	:	2 x 12 sets
- Gate operation	:	operated by manual

(to be continued)

Table VII-13 (3) GENERAL FEATURES OF PROJECT FACILITIES

(10) Operation bridge				
- Type	:	girder type		
- Width	:	5 m		
- Length	:	244 m		
(11) Operation facilities				
- Operation house	:	340 m^2		
- Electric facility	:	diesel generator, 42 kVA x 2 sets		
3. Irrigation Canals				
(1) Headreach				
- Type of canal	:	trapezoidal		
- Base width	:	18 m		
- Side slope of canal	:	1:1.5		
- Length	:	8 km		
- Bifurcation structure	:	1 no.		
(2) Main canal		North	South	Pisang
- Type of canal	:	trapezoided		
- Side slope of canal	:	1:1.5		
- Length	:	50 km	71 km	13 km
- Related structure				
Turnout	:	35 nos.	45 nos.	9 nos.
Check gate	:	15 nos.	19 nos.	4 nos.
Spillway	:	7 nos.	9 nos.	2 nos.
Crossdrain	:	37 nos.	28 nos.	4 nos.
Bridge	:	2 nos.	3 nos.	1 no.
Aqueduct	:	1 no.	-	1 no.
(3) Secondary canal		Sub-area I	Sub-area II	
- Type of canal	:	trapezoidal		
- Side slope of canal	:	1:1.5		
- Length	:	108 km	129 km	
- Related structure				
Turnout	:	188 nos.	221 nos.	
Check gate	:	82 nos.	95 nos.	
Spillway	:	30 nos.	40 nos.	
Crossdrain	:	10 nos.	16 nos.	
Drop	:	37 nos.	55 nos.	

(to be continued)

Table VII-13 (4) GENERAL FEATURES OF PROJECT FACILITIES

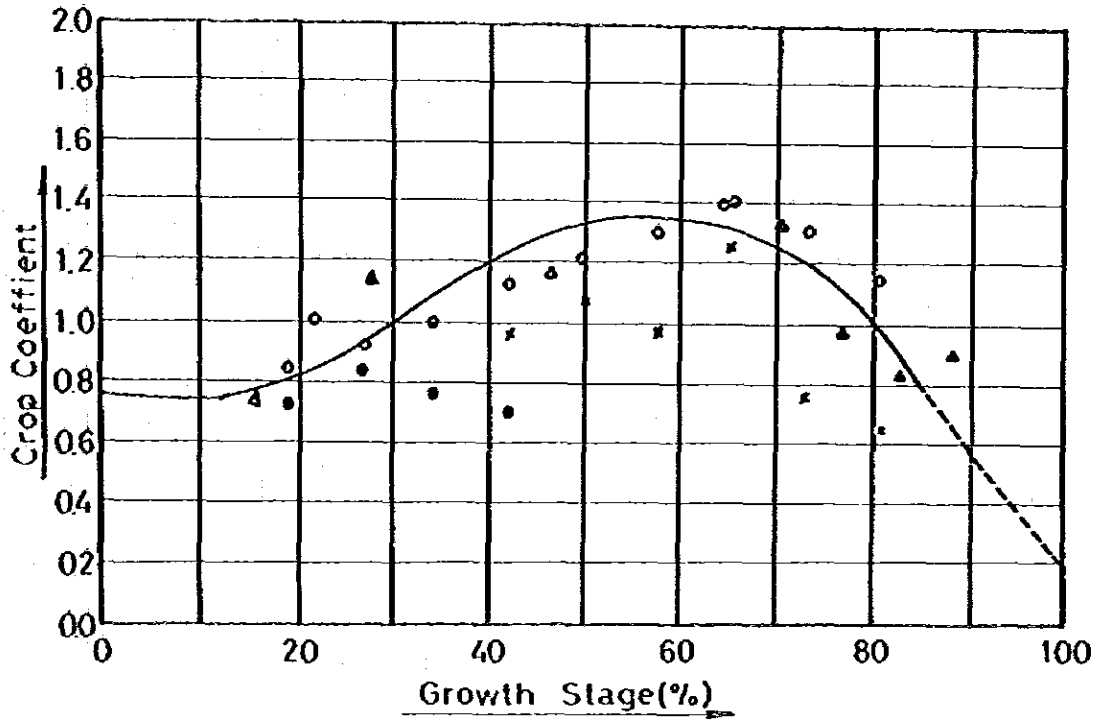
4. Drainage Canals			
(1) Main drain		Sub-area I	
- Type of canal	:	trapezoidal	
- Side slope of canal	:	1:1.5	
- Length	:	180 km	
- Related structure			
Bridge	:	2 nos.	
(2) Secondary drain		Sub-area I	Sub-area II
- Type of canal	:	trapezoidal	
- Side slope of canal	:	1:1.5	
- Length	:	118 km	191 km
- Related structure			
Drainage culvert	:	38 nos.	59 nos.
Drainage drop	:	76 nos.	124 nos.
5. Inspection Road			
(1) Main inspection road		Sub-area I	Sub-area II
- Effective width	:	7 m	
- Pavement material	:	gravel	
- Length	:	50 km	85 km
(2) Secondary inspection road			
- Effective width	:	5 m	
- Pavement material	:	laterial soil	
- Length	:	108 km	129 km
6. Tertiary Development			
(1) Tertiary canal		Sub-area I	Sub-area II
- Type of canal	:	trapezoidal	
- Side slope of canal	:	1:1	
- Length	:	407 km	473 km

(to be continued)

Table VII-13 (5) GENERAL FEATURES OF PROJECT FACILITIES

		Sub-area I	Sub-area II
- Related structure			
Tertiary box	:	1,270 nos.	1,360 nos.
Culvert	:	370 nos.	380 nos.
Crossdrain	:	60 nos.	120 nos.
Drop	:	1,180 nos.	1,600 nos.
(2) Tertiary drain		Sub-area I	Sub-area II
- Type of canal	:	trapezoidal	
- Side slope of canal	:	1:1	
- Length	:	444 km	510 km
- Related structure			
Drainage culvert	:	370 nos.	360 nos.
Drainage drop	:	540 nos.	610 nos.
(3) Tertiary inspection road		Sub-area I	Sub-area II
- Effective width		3 m	
- Length	:	518 km	546 km
(4) Quaternary system	:	18,500 ha	18,200 ha
7. Land Reclamation		Sub-area I	Sub-area II
- Land clearing area	:	6,010 ha	10,320 ha
- Land leveling area	:	7,900 ha	15,480 ha

Fig.VII-1 CROP COEFFICIENT CURVE FOR PADDY



x Observed at Cintaranis (Wet seaseon)

● - do - (Dry seaseon)

o Observed at Belitang (Wet seaseon)

▲ - do - (Dry seaseon)

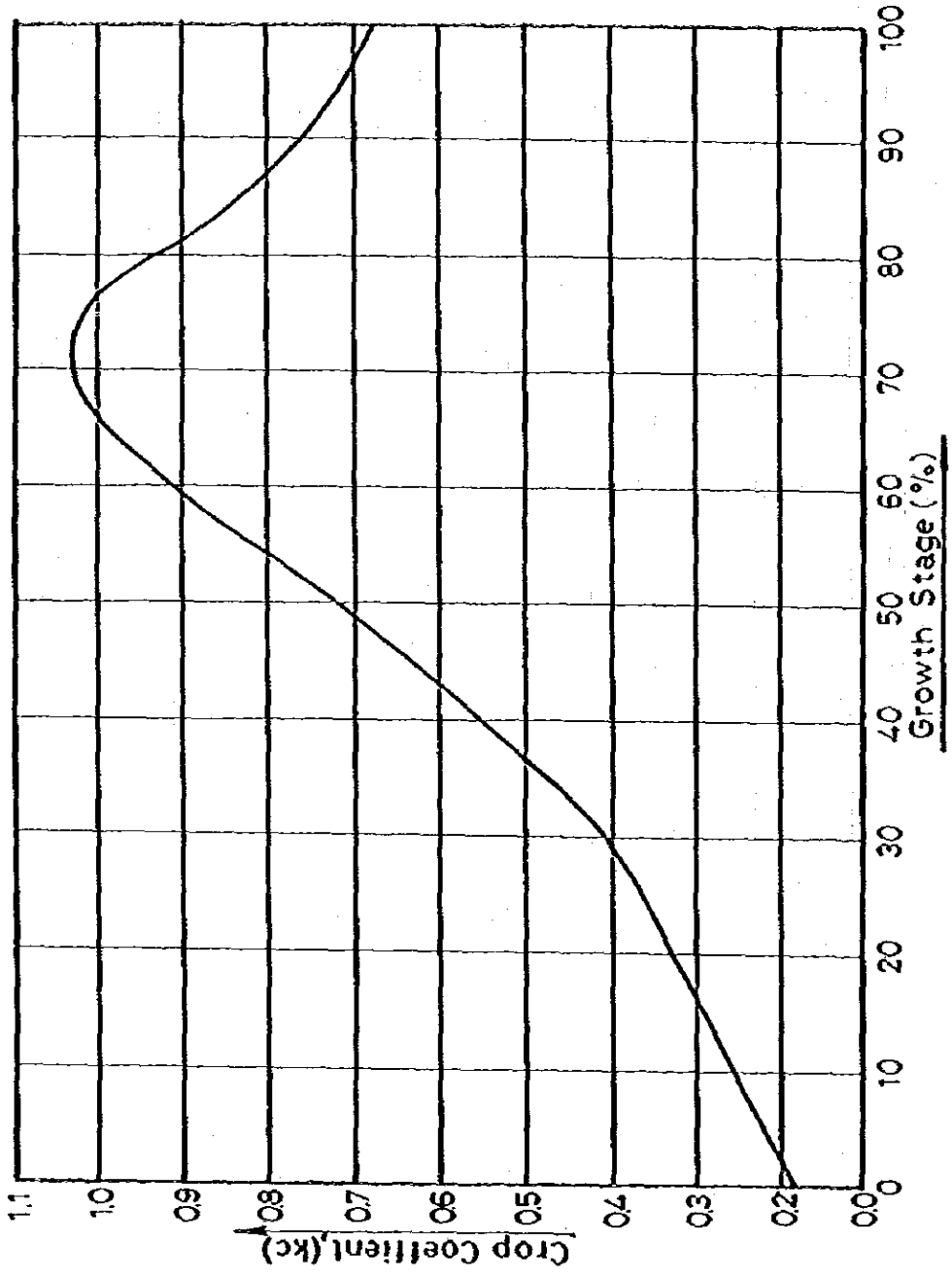


Fig. VII-2 CROP COEFFICIENT CURVE FOR SOYBEANS

Fig.VII-3 CROP COEFFICIENT CURVE FOR PEANUTS

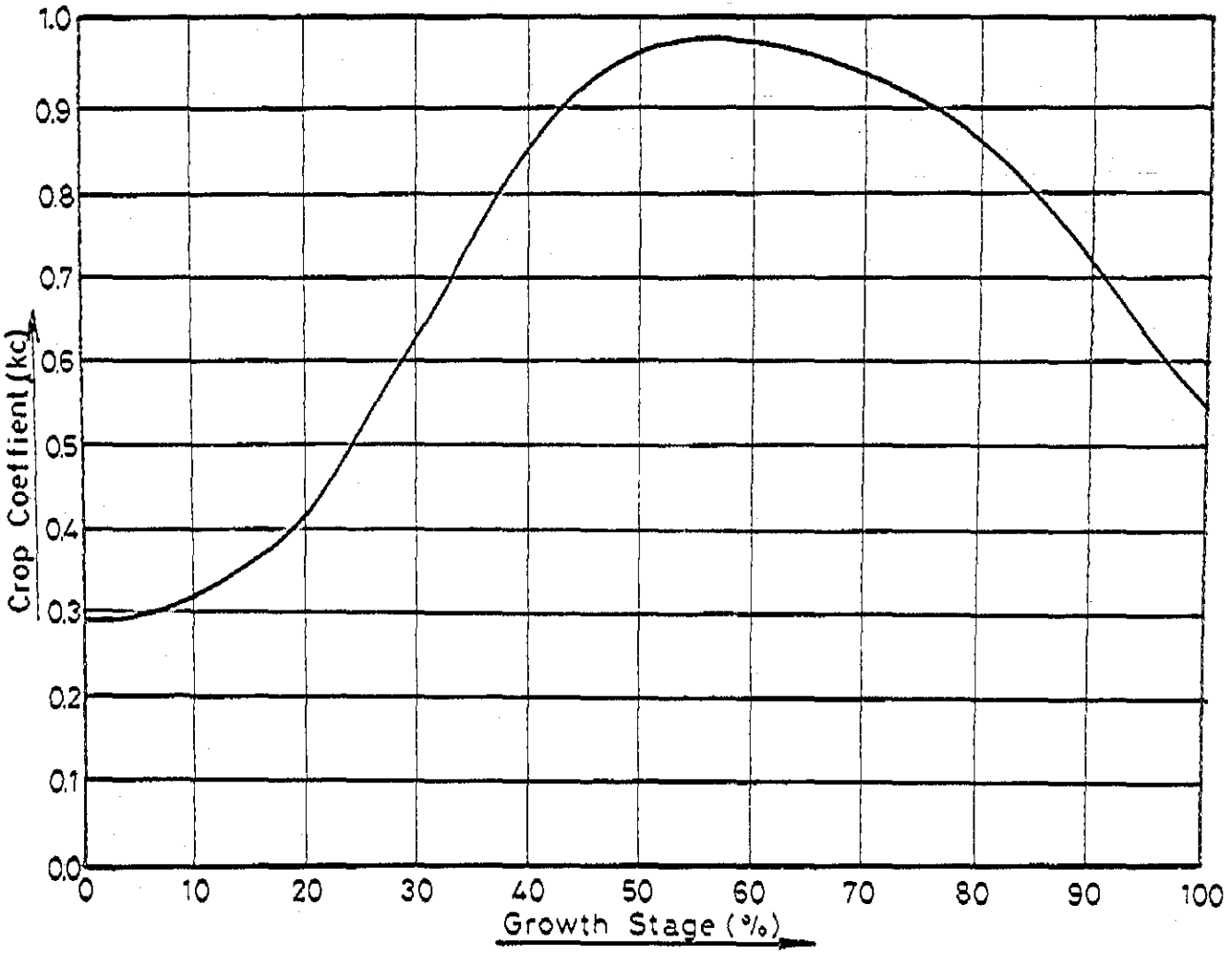
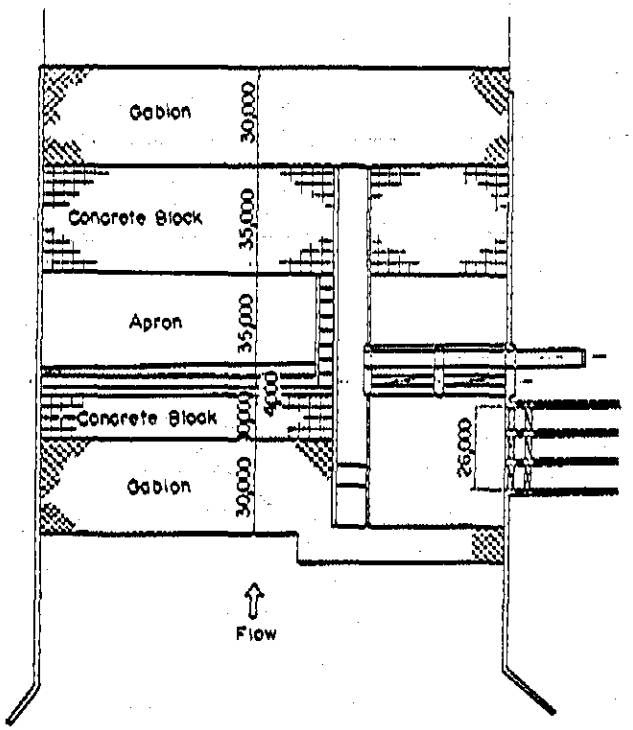
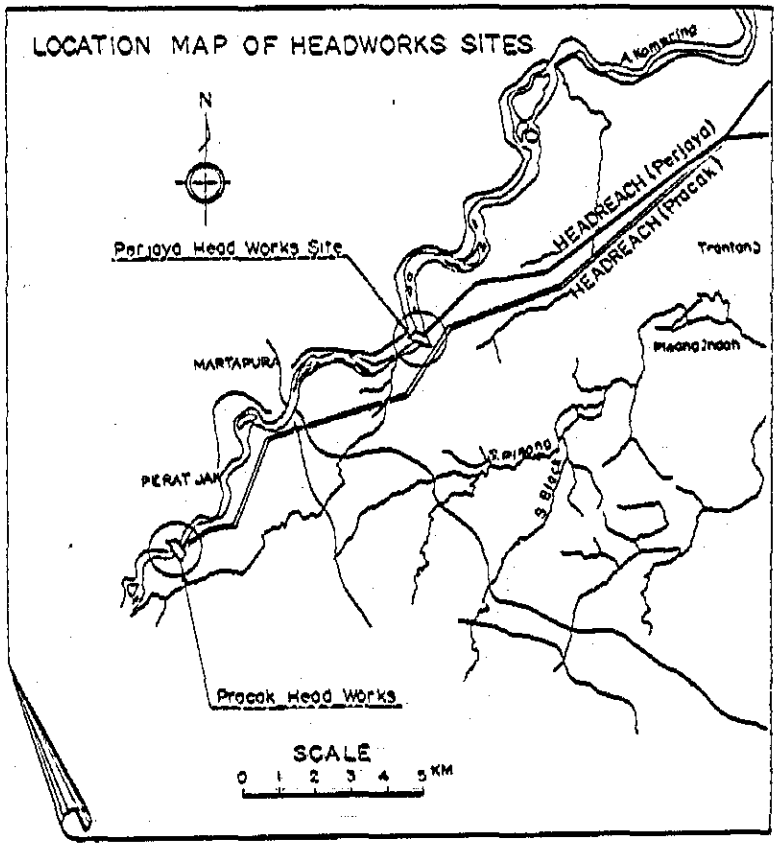
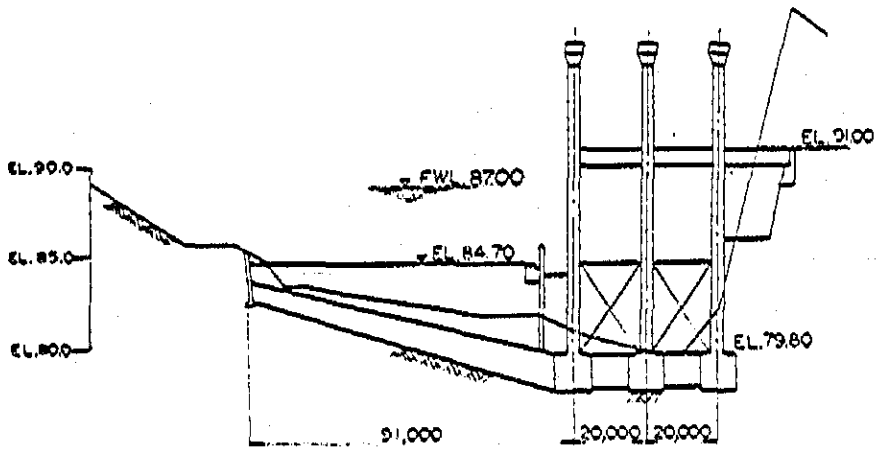


Fig. VII-4 ALTERNATIVE HEADWORKS, PRACAK CASE-3



PLAN



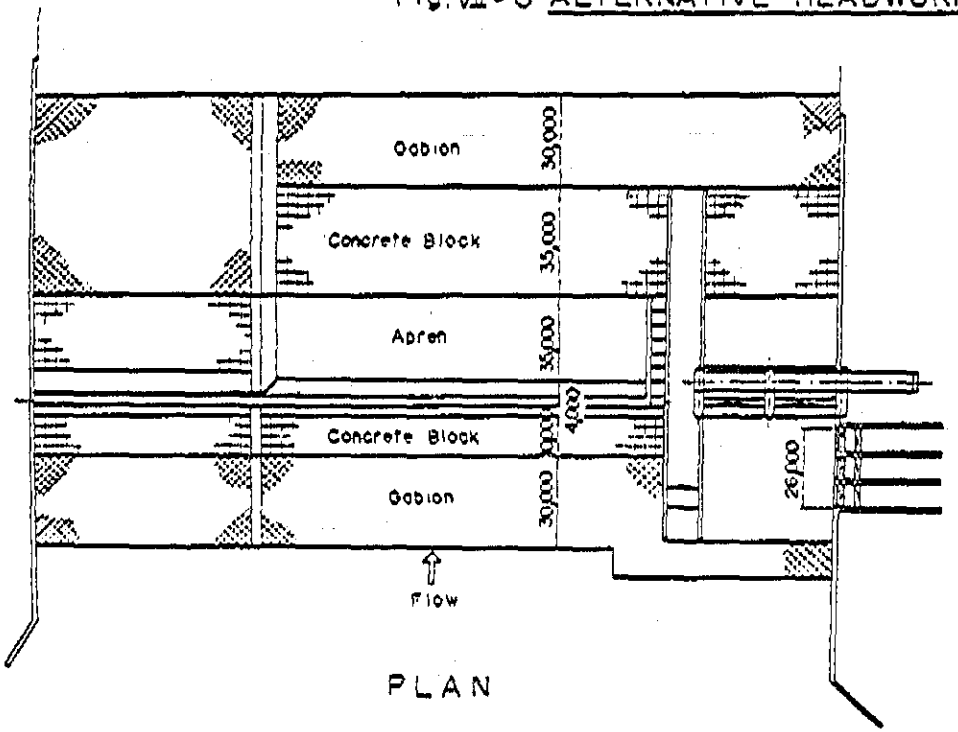


FROFILE

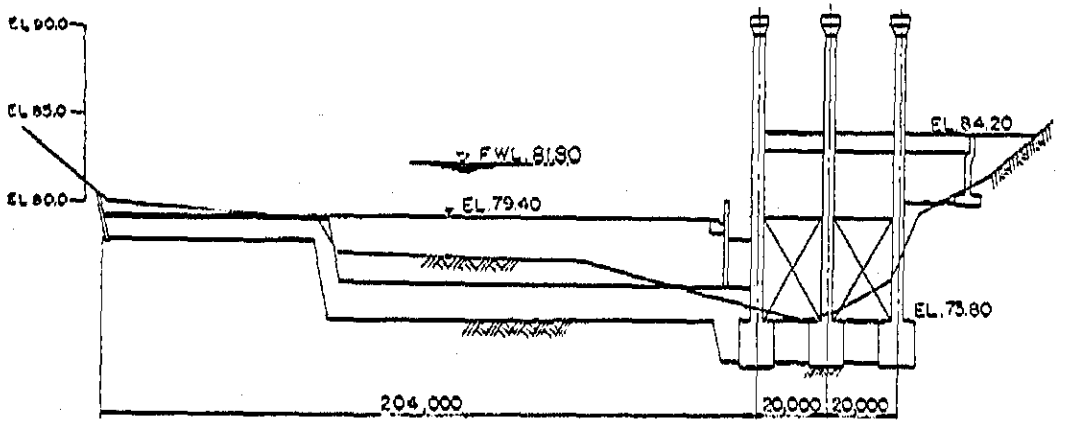
Principal Feautures

Length of Fixed Weir	91 m
Width of Scouring Sluice	40 m
Width of Intake Structure	26 m
Intake Water Level	WL 84.60 m
Diverted Discharge	44 m^3/sec

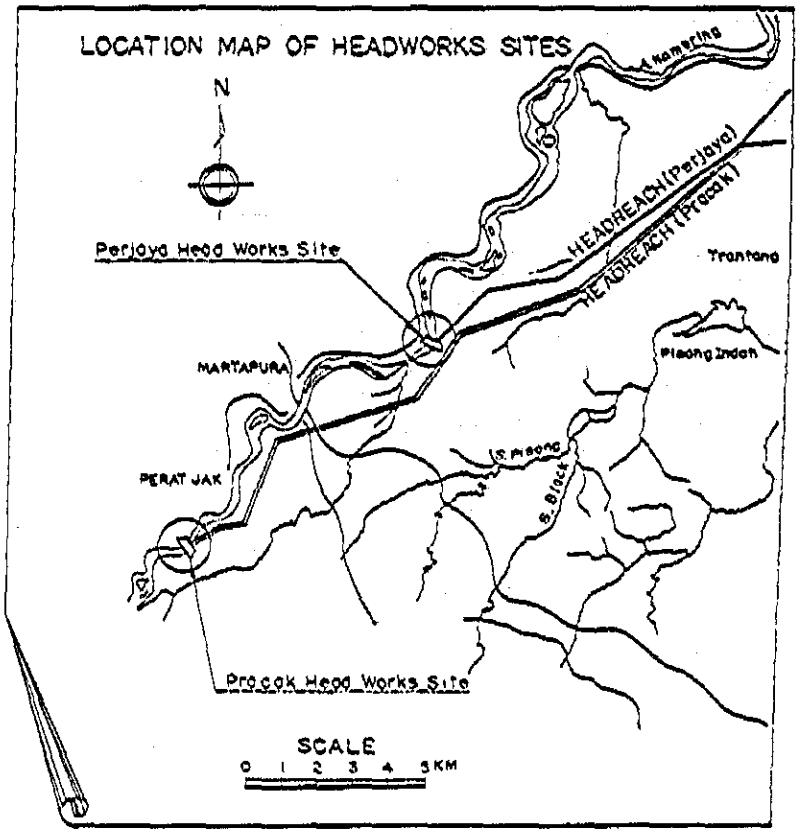
Fig.VII-5 ALTERNATIVE HEADWORKS, PERJAYA CASE - 3



PLAN



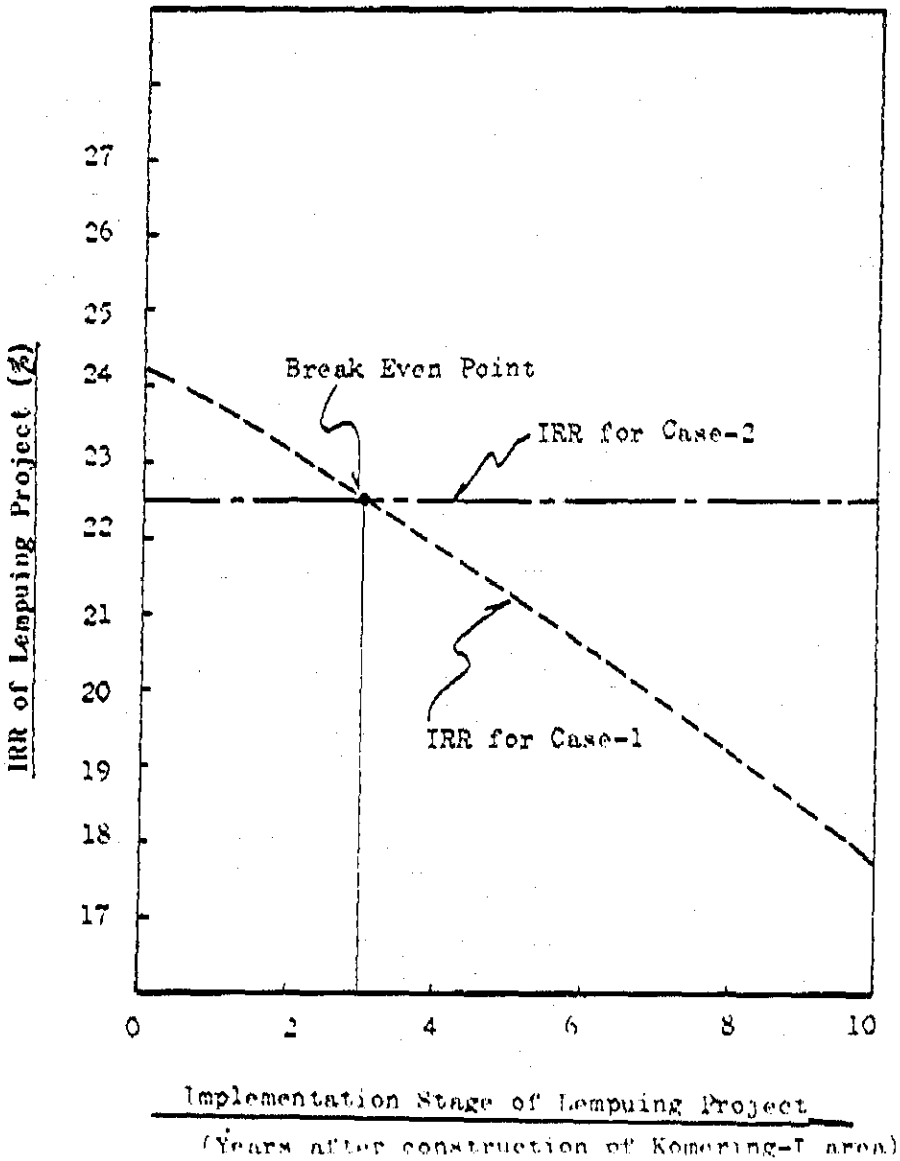
PROFILE



Principal Feautures

Length of Fixed Weir	204 m
Width of Scouring Sluice	40 m
Width of Intake Structure	26 m
Intake Water Level	WL.79.30 m
Diverted Discharge	44 m^3/sec

Fig. VII-6 CHOICE BETWEEN JOINT CONSTRUCTION AND FUTURE EXPANSION OF FACILITIES FOR LEMPUING PROJECT



Assumption:

(1) The construction costs of proper facilities and benefit for the Lempuing Project which were estimated in the comprehensive report, are employed in this study as follows:

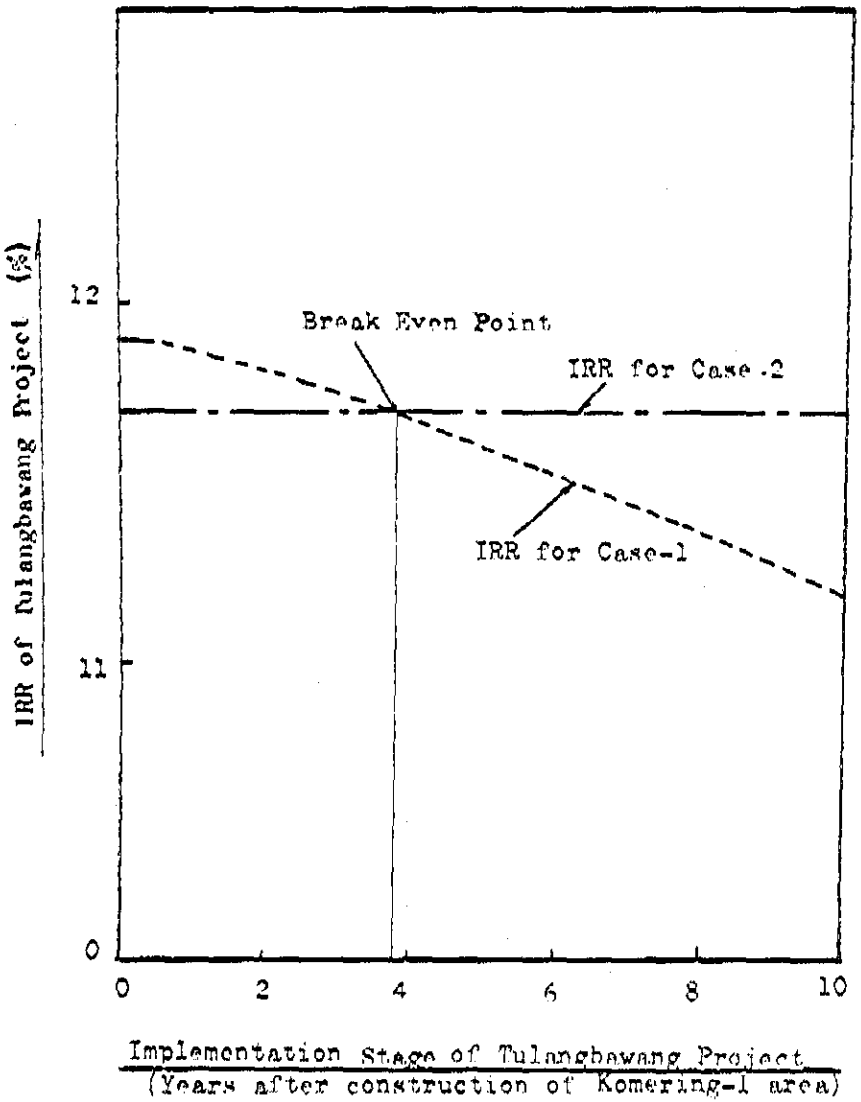
- Construction cost of proper facilities for Lempuing Project:
  84,850 (10^3US$)
- O & M cost for Lempuing Area:
  402 (10^3US$)
- Replacement cost : (20 years)
  100 (10^3US$)
- Annual incremental benefit:
  18,190 (10^3US$)

(2) The construction cost estimated is the value at the completion time. The O & M cost occurs immediately after completion.

(3) In calculation of IRR, the present worth of case-1 is discounted to the investment time of the Lempuing project works (case-2).

(4) For this study, the allocated costs of dam construction are not included.

FIG. VII-7 CHOICE BETWEEN JOINT CONSTRUCTION AND FUTURE EXPANSION OF FACILITIES FOR TULANGBAWANG PROJECT



Assumption:

(1) The construction costs of proper facilities and benefits for the Tulangbawang project estimated in the comprehensive report are employed in this study as follows:

- Construction cost of proper facilities for Tulangbawang Project:
  478.120 (10^3US$)
- O & M cost for Tulangbawang Area:
  1,749 (10^3US$)
- Replacement cost: (20 years)
  650 (10^3US$)
- Annual incremental benefit:
  54.100 (10^3US$)

(2) The construction cost estimated is the value at the completion time. The O & M cost occurs immediately after completion.

(3) In calculation of IRR, the present worth of case-1 is discounted to the investment time of the Tulangbawang project works (case-2).

(4) For this study, the allocated costs of dam construction are not included.

Fig. VII-8 IRRIGATION DIAGRAM

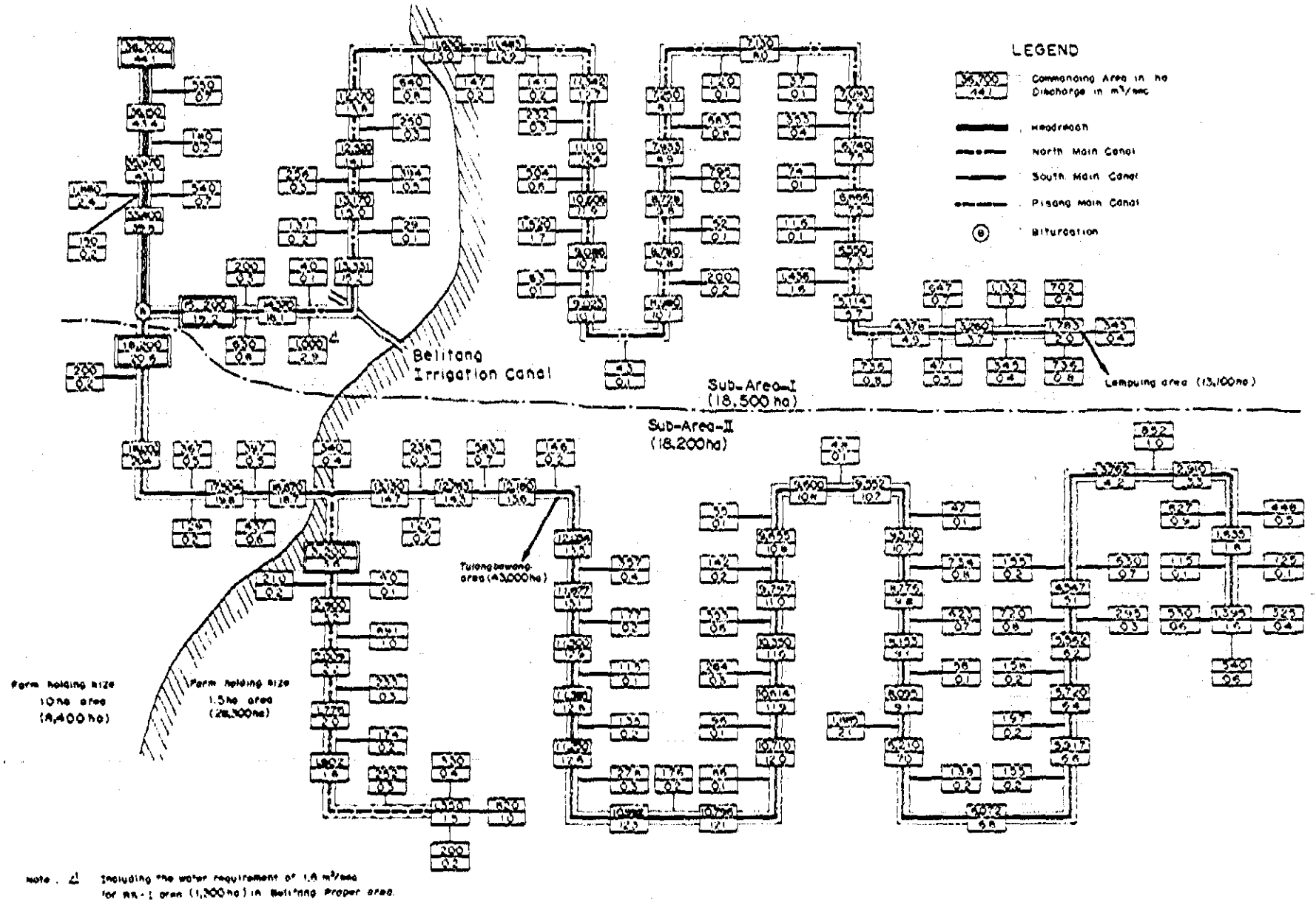
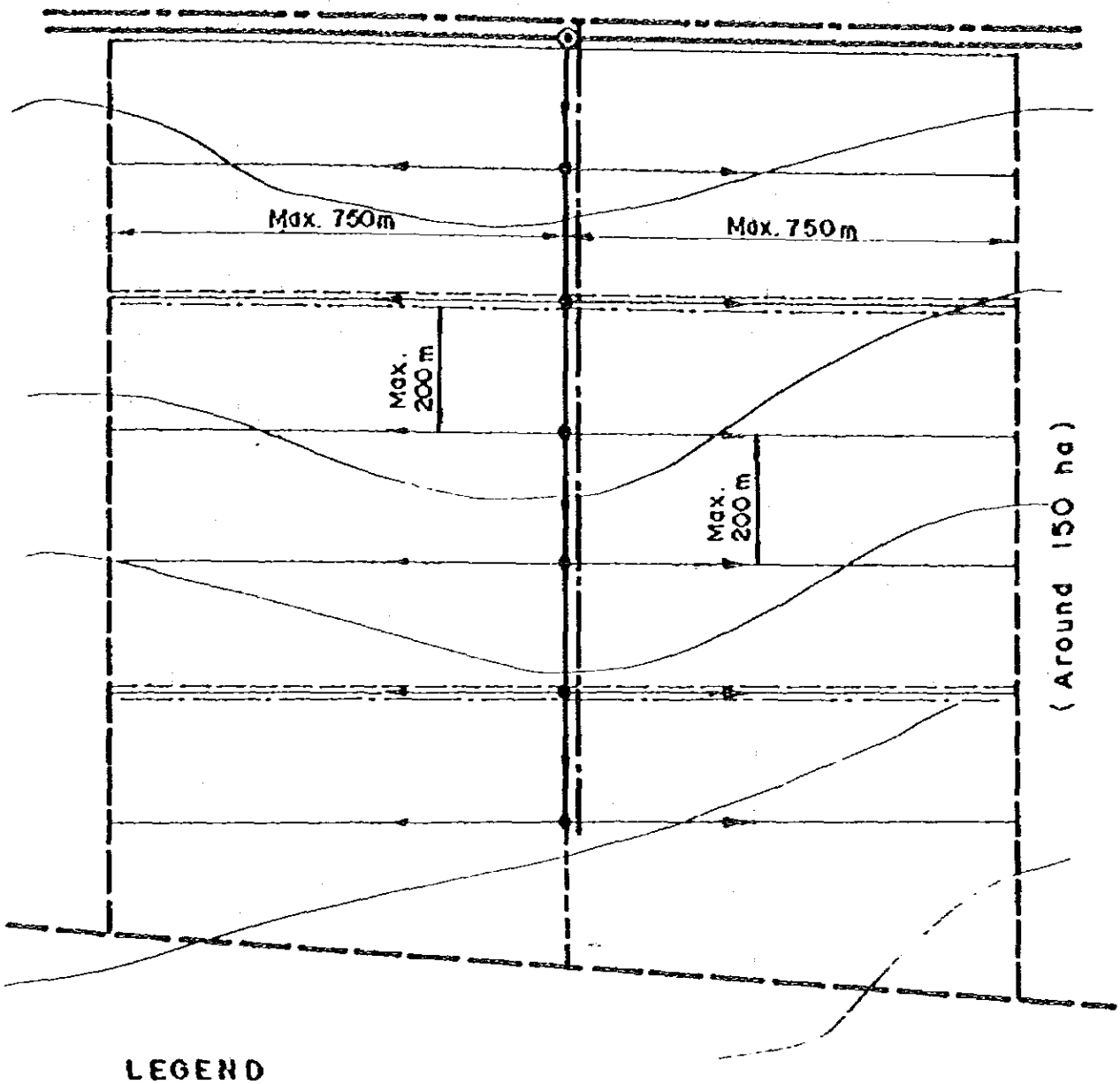


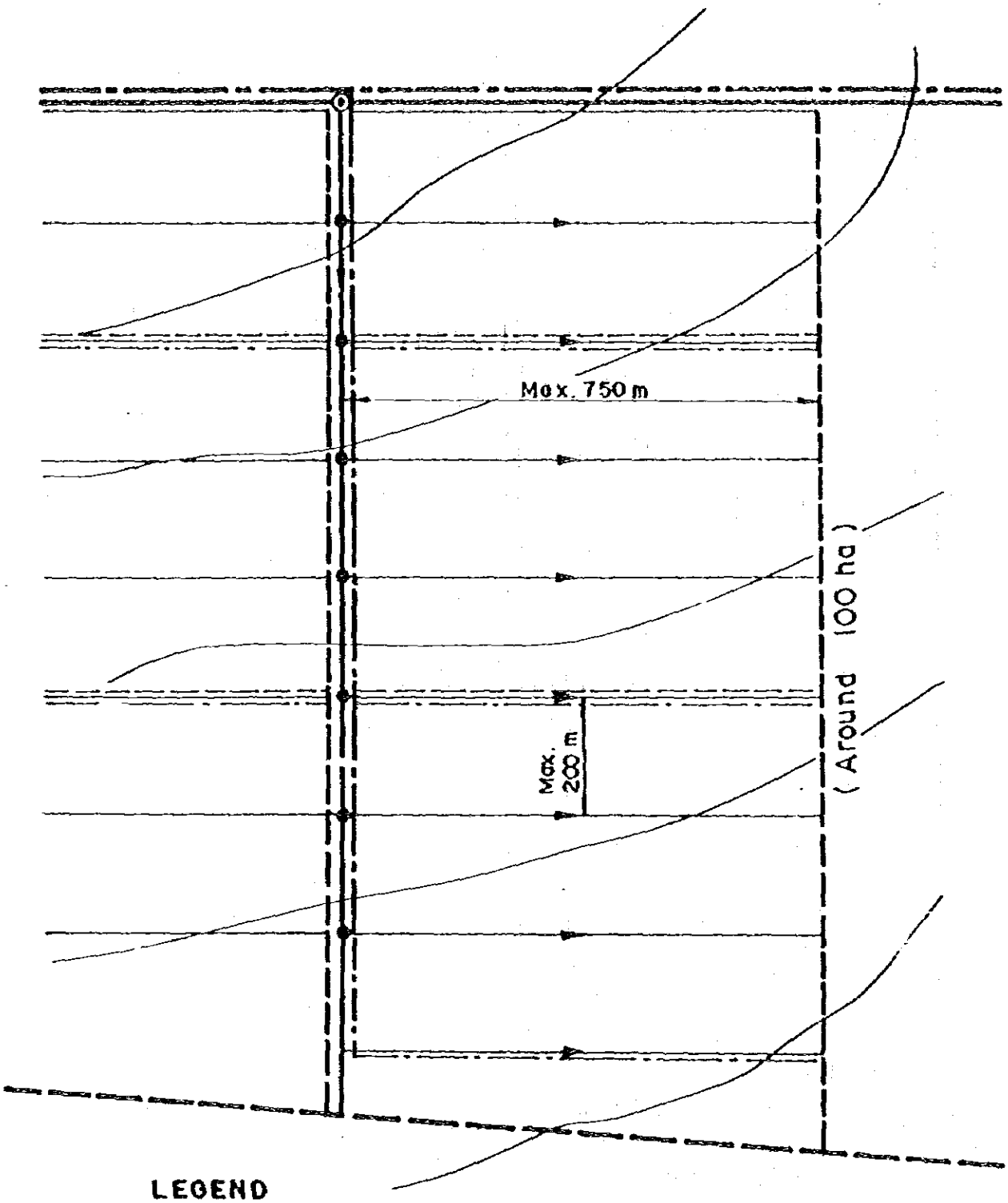
Fig. VII-9(1) TYPICAL LAYOUT OF TERTIARY SYSTEM (1)



LEGEND

- Main or Secondary Canal
- Tertiary Canal
- Quaternary Canal
- Main or Secondary Drain
- Tertiary Drain
- Quaternary Drain
- Main or Secondary Inspection Road
- Tertiary Inspection Road
- Farm Operation Road
- ● Turnout for Tertiary Canal
- ● Tertiary Division Box

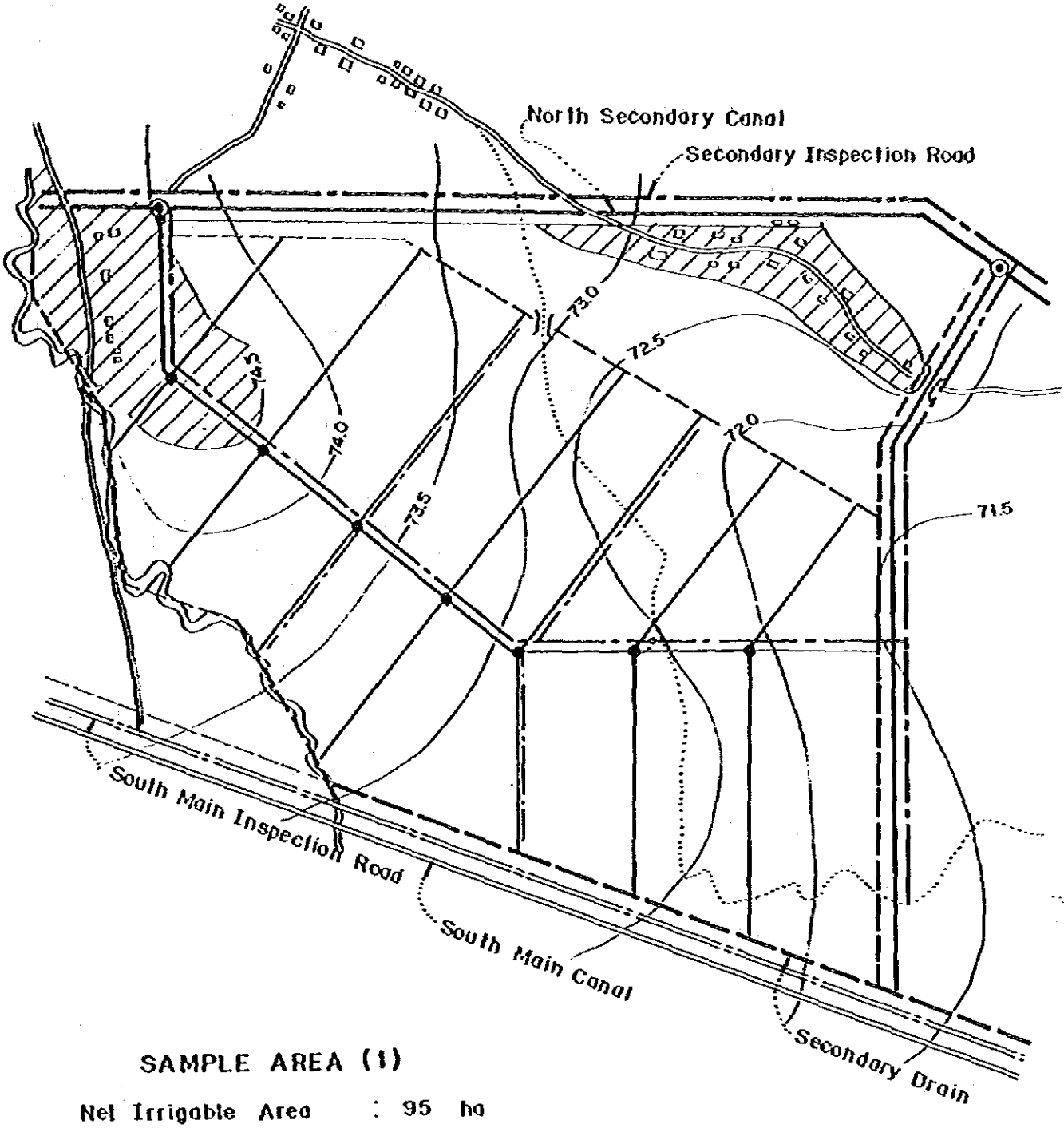
Fig. VII-9(2) TYPICAL LAYOUT OF TERTIARY SYSTEM (2)



LEGEND

- Main or Secondary Canal
- Tertiary Canal
- Quaternary Canal
- Main or Secondary Drain
- Tertiary Drain
- Quaternary Drain
- Main or Secondary Inspection Road
- Tertiary Inspection Road
- Farm Operation Road
- Turnout for Tertiary Canal
- Tertiary Division Box

Fig. VII-10(1) SAMPLE LAYOUT OF TERTIARY SYSTEM (1)



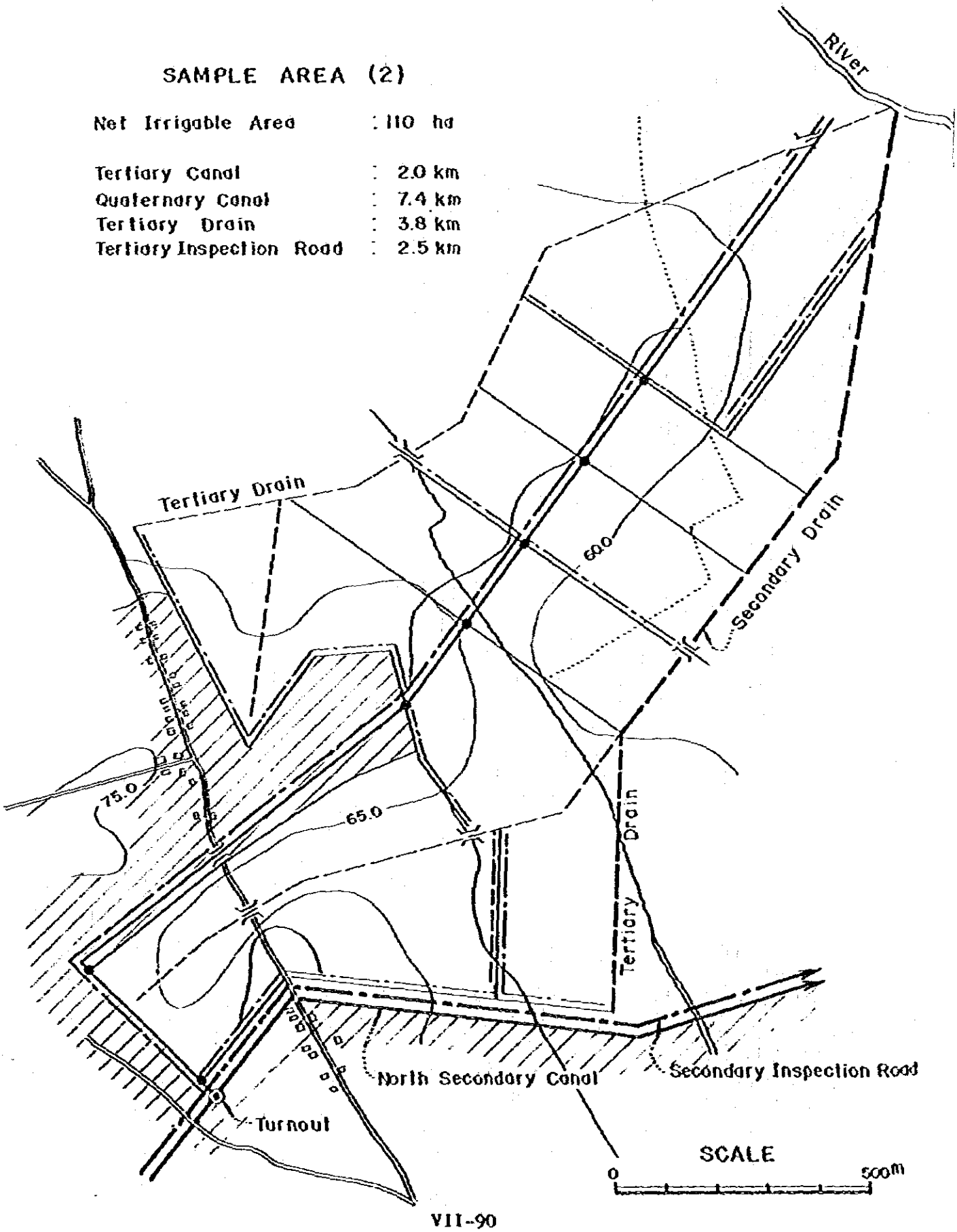
SAMPLE AREA (1)

Net Irrigable Area	:	95 ha
Tertiary Canal	:	1.6 km
Quaternary Canal	:	6.6 km
Tertiary Drain	:	2.2 km
Tertiary Inspection Road	:	1.7 km

SCALE

0 500m

Fig. VII-10(2) SAMPLE LAYOUT OF TERTIARY SYSTEM(2)



ANNEX VIII

PROJECT IMPLEMENTION SCHEDULE

ANNEX - VIII

PROJECT IMPLEMENTATION SCHEDULE

1. BASIC CONSIDERATIONS

The project implementation schedule is prepared based on the following considerations:

(1) The project mobilization which includes financing, legalization, establishment of the project organization will be completed by the end of March 1983.

(2) Considering the large scale of the project cost, the project is to be implemented largely in the five stages, i.e., (i) detailed design and construction of headworks and headreach, (ii) detailed design and implementation of Sub-area-I including tertiary development of 2,000 ha, (iii) tertiary development of 16,500 ha in Sub-area-I, (iv) detailed design and implementation of Sub-area-II including tertiary development of 2,000 ha and (v) tertiary development of 16,200 ha in Sub-area-II.

(3) Annual workable days for construction equipment are estimated to be 140 days based on the rainfall records for 17 years.

(4) Taking into account the scale of this project, the mechanized construction will principally be introduced in the main construction works. In order to maximize the employment opportunity in and around the project area, however, man-power construction will be adopted as much as possible. In this context, large-scale civil works such as headworks, headreach, regulating dam, main canals and main drains will be carried out mainly by heavy construction machinery. The minor civil works for secondary canal system and tertiary development will be carried out mainly by man-power with minor construction equipment.

2. IMPLEMENTATION SCHEDULE

2.1 Preparatory Works

The time required for the preparatory works such as aerial photo mapping and construction of office and quarters is estimated to be 17 months as shown in Fig. VIII-1.

Topographic map on a scale of 1:5,000 with a contour interval of 0.5 m has to be prepared for 200 km^2 of the eastern half of the Sub-area-II, for which mapping work has not completed yet. This mapping work will be completed before start of the detailed design of the eastern half of the Sub-area-II; by the end of October 1984.

The project office and quarters will be completed prior to the major construction works. This work will be started from October 1984 and completed by the end of September 1985. The land acquisition for the construction of project facilities will be completed one year ahead of the construction work.

2.2 Headworks and headreach

The detailed design works for the headworks and headreach will be carried out from May 1983 to April 1984, including the time necessary for survey and investigation and the detailed design. The headworks consist of various components such as diversion weir, intake, driving channel and settling basin. The time required for the construction of headworks will be around 3 years from May 1985 taking four dry seasons as shown in Fig. VIII-1.

The construction of the diversion weir will be carried out by dividing it into two steps. The right side portion of the weir including movable weir, raft way, fish ladder and intake structure will be constructed in two dry seasons of 1985 and 1986. The left side portion; mostly fix weir, will be constructed in two dry seasons of 1987 and 1988. The coffering and dewatering works would carefully be carried out and maintained until the concrete weir is completed

The excavation work for the driving channel will be commenced from the beginning of 1986 dry season and last for five months. Following this work, concrete lining work will be started and completed after one year from its commencement. The construction of the settling basin will be completed in one and half years starting from May 1987.

The construction of headreach will be carried out in parallel with that of the diversion weir. The excavation work will first be started from the dry season of 1986 and completed by the end of 1987 dry season after spending two dry seasons. The construction of concrete structures required on and under the headreach, such as bridges, culverts and crossdrains, will follow the excavation work of the channel. This work will be completed by the end of 1988 dry season.

2.3 Sub-area-I

The main works involved in this stage are detailed design of main and secondary canal system including inspection roads, main and secondary drainage canal system and tertiary development of 2,000 ha, their construction and land reclamation in Sub-area-I. The detailed design works will be commenced from April 1984 and last for 15 months before construction. The construction work will be carried out from the upstream area to the downstream area, so that irrigated farming can be started from the upstream area whenever the construction work is completed, without waiting for the completion of the total works.

The land reclamation will be started from the start of implementation work in Sub-area-I, i.e. from May 1986, and completed by the end of the dry season of 1990 after taking around four and half years. The jungle clearing for the land to be reclaimed would be done by transmigrants before the start of reclamation work.

The construction of main canal including main inspection road will be carried out in parallel with the reclamation work mentioned above, i.e for four and half years from May 1986 to September 1990. Following the main canal construction, the secondary canal including secondary inspection road will be implemented during the period from May 1987 to

September 1990. The construction work will be carried out from upper reach to downward. In the rainy season, the excavation work will be stopped and the main effort will be paid to the construction of related structures such as check gates, culverts, bridges, aqueducts, turnouts, division boxes, etc. The excavated soils in the canal construction will be utilized as much as possible for canal and road embankment if the soils are suitable. Since the inspection roads can also be used for the access in the construction period, their construction will be started ahead of the construction of canal. The gravel metalling on the main inspection road and the laterite pavement on the secondary inspection road, however, will be carried out after the completion of canals alongside the roads.

The improvement of the Macak and the Belitang rivers for the use as the main drains will be made over three and half years from May 1986 to September 1989. Since the length and the size of the main drains are so large, the heavy construction machinery such as dragline and swamp bulldozer would be required to large extent. The excavation work of secondary drains will be started from May 1987 and completed by September 1990 after spending four dry season.

The tertiary development in this stage includes the construction of tertiary canal and tertiary inspection road, tertiary drainage canal and related structures for 2,000 ha of the upper reach in Sub-area-I. The tertiary development will started from May 1987 and completed by the end of September 1988. The quarternary canals will be constructed by farmers themselves as soon as irrigation water is available to their farmlands.

2.4 Tertiary Development for Sub-area-I

The tertiary development for 16,500 ha of remaining area in Sub-area-I will be carried out following the tertiary development of 2,000 ha in the previous stage. The tertiary development in this stage will be carried out in parallel with the detailed design work. The time required for implementation will be around 30 months from May 1988.

2.5 Sub-area-II

Other than the land reclamation, construction of irrigation canal system including inspection roads and drainage canal system and tertiary development of 2,000 ha, the main construction works involved in this stage are the Ranau regulating dam and the expansion of the Selabung river from the outlet of Lake Ranau to the dam site.

The detailed design works for the above works will start from July 1985 and last for 14 months including the necessary survey and investigation.

The construction of the regulating dam will require one and half years from April 1988 to September 1989. The expansion of the Selabung river will be implemented in parallel with the regulating dam. Both construction works will efficiently be carried out throughout the year regardless the rainy season, because the discharge pattern of the Selabung river varies only within the range from 15 m^3/sec to 20 m^3/sec in a year.

The land reclamation and construction of irrigation canal system including inspection road, drainage canal system and tertiary development in this sub-area will be carried out in the same manner as that of the Sub-area-I as shown in Fig. VIII-1. The implementation work in this sub-area will be commenced from May 1989 and completed by September 1991.

2.6 Tertiary Development for Sub-area-II

The tertiary development for 16,200 ha of remaining area in Sub-area-II will be start from May 1989 and completed by the end of September 1991. In this stage, the detailed design works will be included.

3. CONSTRUCTION MACHINERY

The major civil works of the project would principally be carried out by heavy construction machinery. The type and number of construction

machinery to be required for the major civil works are estimated based on the work quantity, construction time schedule and the natural condition in the project area. Table VIII-1 shows the required type and number of construction machinery.

Table VIII-1 (1) REQUIRED MAJOR CONSTRUCTION MACHINERY

No.	Machinery	Specification	Required Number
1.	Bulldozer	32t	15
2.	Bulldozer	22t	90
3.	Bulldozer	12t	10
4.	Bulldozer, swamp	12t	20
5.	Bulldozer, ripper	32t	4
6.	Backhoe	1.2m^3	10
7.	Backhoe	0.7m^3	30
8.	Backhoe	0.3m^3	10
9.	Crawler loader	2m^3	10
10.	Wheel loader	2m^3	2
11.	Motor scraper	11m^3	50
12.	Motor grader	11t	5
13.	Dump truck	10t	140
14.	Dump truck	6t	160
15.	Cargo truck	6t	40
16.	Fuel tanker	5kl	10
17.	Water tanker	6kl	5
18.	Truck mixer	3m^3	20
19.	Truck crane	30t	4
20.	Truck crane	20t	5
21.	Truck w/crane	6t	2
22.	Diesel pile hammer	3t	2
23.	Vibration pile driver	4t	2
24	Dragline	1.2m^3	2
25.	Vibration roller	3t	3
26.	Road roller	8t	2
27.	Tire roller	8t	2
28	Tamper	80kg	40
29.	Crawler drill	5t	2
30.	Jack hammer	20kg	10
31.	Submergible pump	6"φ	10
32.	Engine centrifugal pump	6"φ	20

(to be continued)

Table VIII-1 (2) REQUIRED MAJOR CONSTRUCTION MACHINERY

No.	Machinery	Specification	Required Number
33.	Engine centrifugal pump	4"ϕ	20
34.	Concrete pump truck	20m^3/hr	2
35.	Engine concrete mixer	0.2m^3	15
36.	Concrete mixing plant	20m^3/hr	1
37.	Concrete mixing plant	10m^3/hr	1
38.	Concrete vibrator	5"ϕ	5
39.	Concrete vibrator	2"ϕ	20
40.	Concrete bucket	2m^3	2
41.	Concrete bucket	1m^3	5
42.	Concrete slope form	20m-gantry	1
43.	Aggregate screen plant	150t/hr	1
44.	Aggregate screen plant	30t/hr	1
45.	Diesel generator	200KVA	5
46.	Diesel generator	50KVA	5
47.	Engine compressor	10m^3/min	5
48.	Grease car	6t	5
49.	Repair shop car	6t	2
50.	Engine beltconveyor	7m	40
51.	Repair shop	L.S.	3
52.	Water supply system	L.S.	3
53.	Work shop	L.S.	2

Fig.VIII-1 (1) PROJECT IMPLEMENTATION SCHEDULE (PROPOSED)

WORK ITEMS	WORK QUANTITY
1. PREPARATORY WORKS	
a) Aerial photo mapping	200 km²
b) Office and quarters	L.S
c) Land acquisition	L.S
2. HEADWORKS AND HEADREACH	
a) Detailed design	
b) Headworks	
~ Diversion weir	Ex. 64,000m³ Con. 64,000m³
~ Driving channel	2,000m³
~ Settling basin	3,700m³
~ Metal works	330 t
c) Headreach	8 km
3. SUB - AREA - I	
a) Detailed design	
b) Land reclamation	L.S
c) Main canal and inspection road	50 km
d) Secondary canal and inspection road	108 km
e) Main drain	180 km
f) Secondary drain	118 km
g) Tertiary development	2,000 ha
4. TERTIARY DEVELOPMENT (Sub-area-I)	16,500 ha
5. SUB - AREA - II	
a) Detailed design	
b) Ranau regulating dam	Ex. 18,700m³ Con. 5,000m³
c) Land reclamation	L.S
d) Main canal and inspection road	85 km
e) Secondary canal and inspection road	129 km
f) Secondary drain	191 km
g) Tertiary development	2,000 ha
6. TERTIARY DEVELOPMENT (Sub-area-II)	16,200 ha
PILOT DEMONSTRATION SCHEME	700 ha

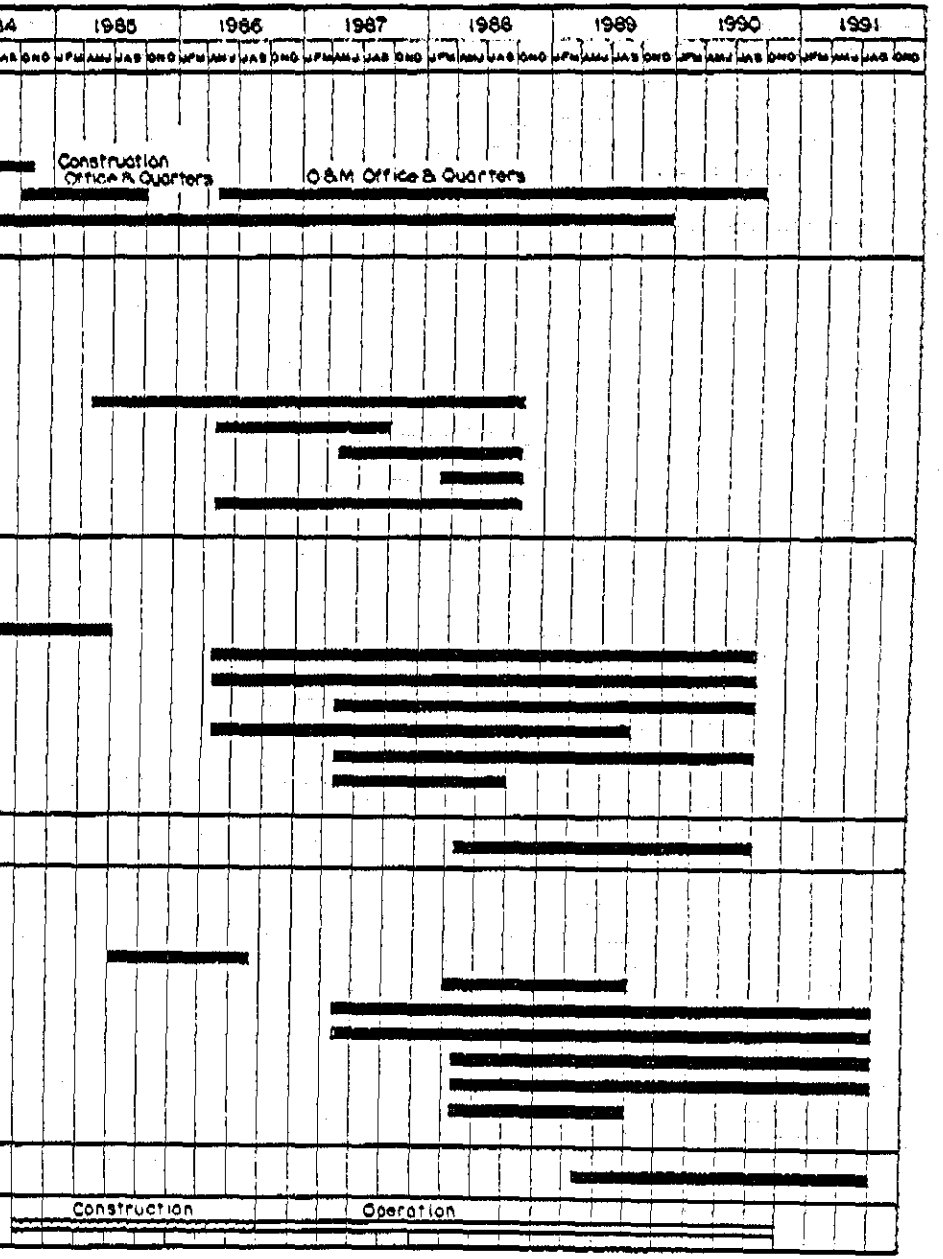
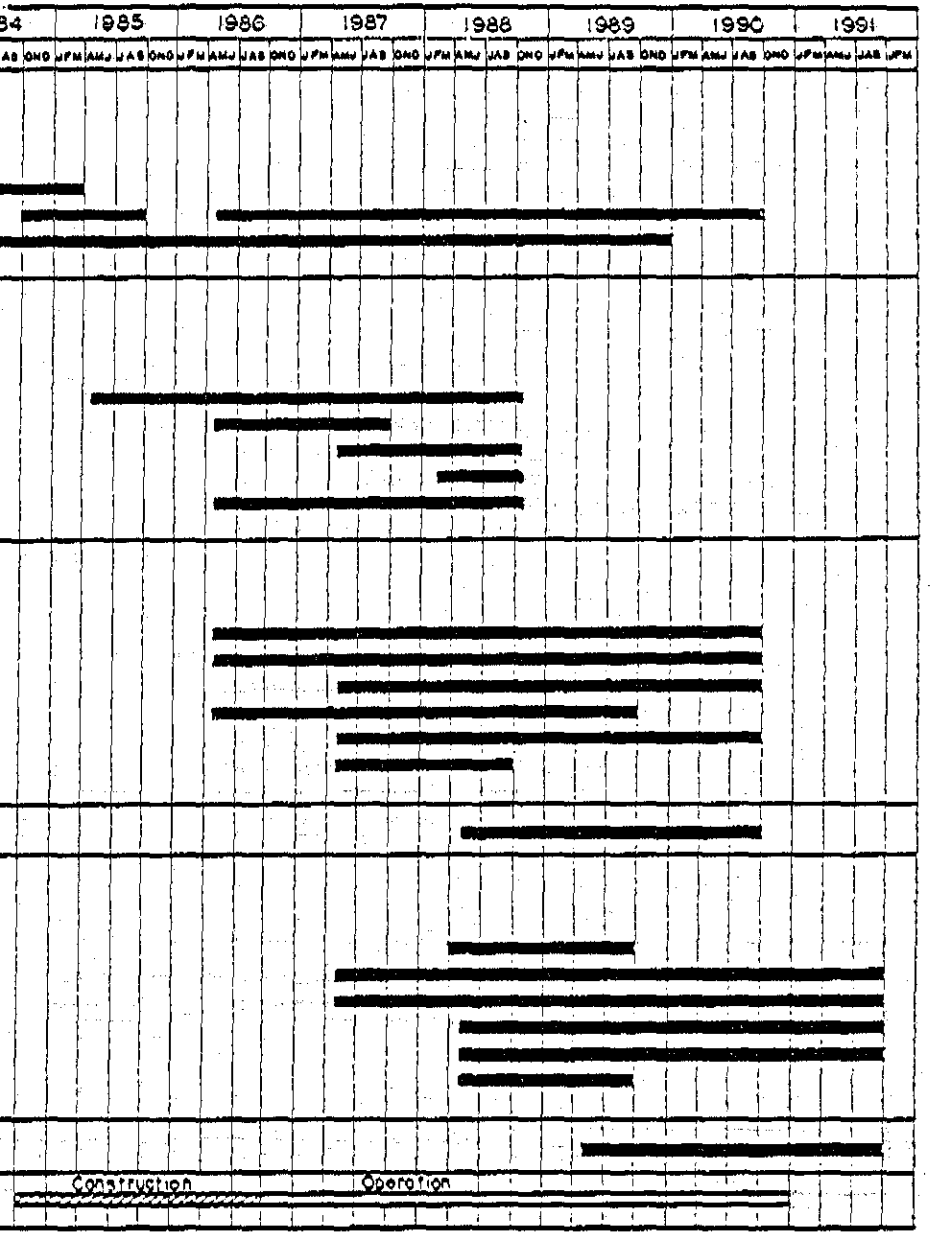


Fig. VIII-1 (2) PROJECT IMPLEMENTATION SCHEDULE (ALTERNATIVE)

WORK ITEMS	WORK QUANTITY
1. PREPARATORY WORKS	
a) Aerial photo mapping	200km²
b) Detailed design	36,700ha
c) Office and quarters	L.S
d) Land acquisition	L.S
2. HEADWORKS AND HEADREACH	
a) Headworks	
- Diversion weir	Ex. 64,000m³ / Con. 41,000m³
- Driving channel	Ex. 189,000m³ / Con. 10,000m³
- Settling basin	Ex. 20,000m³ / Con. 6,000m³
- Metal works	330t
b) Headreach	8km
3. SUB - AREA - I	
a) Land reclamation	L.S
b) Main canal and inspection road	50km
c) Secondary canal and inspection road	106km
d) Main drain	180km
e) Secondary drain	116km
f) Tertiary development	2,000ha
4. TERTIARY DEVELOPMENT (Sub-area-I)	16,500ha
5. SUB - AREA - II	
a) Randu regulating dam	Ex. 18,700m / 5,000m
b) Land reclamation	L.S
c) Main canal and inspection road	85km
d) Secondary canal and inspection road	129km
e) Secondary drain	191km
f) Tertiary development	2,000ha
6. TERTIARY DEVELOPMENT (Sub-area-II)	16,200ha
PILOT DEMONSTRATION SCHEME	700ha



ANNEX IX

PROJECT ORGANIZATION AND MANAGEMENT

ANNEX - IX

PROJECT ORGANIZATION AND MANAGEMENT

1. PROPOSED ORGANIZATION

1.1 Organization in Construction Stage

In order to implement the project successfully, it is proposed to establish the Project Construction Office under the superintendence of the Provincial Public Works. The proposed organization structure is shown in Fig. IX-1. Main functions of the Project Construction Office are as follows:

(1) financial arrangement needed for construction of irrigation, drainage and road networks, and operation and maintenance of project facilities,

(2) design and construction supervision of all the construction activities down to tertiary system,

(3) assistance to farmers in construction of quaternary system,

(4) planning, design, construction supervision and operation of a pilot demonstration scheme, and

(5) accounting and management of construction works.

The Project Construction Office will consist of one main office and five branch offices. It is proposed to organize and construct the main office at Martapura before getting into the major construction works of the project. The branch offices will be constructed at Perjaya, Bumiharjo, Sukaharjo, Rejodadi and Muaraharju in keeping with the progress of the project construction works.

The Project Office will have two working divisions; Technical Division and Administrative Division. The Technical Division will be responsible for all the engineering matters relating to construction of the project facilities. This Division will consist of four sections of Design, Construction, Operation and Workshop. The Operation Section, however, will be established immediately before completion of the pilot demonstration scheme.

The Administrative Division will be responsible for accounting, financing, administrative affairs and procurement for the implementation, operation and maintenance of the project. This Division will consist of four sections; Accounting, Financing, Personnel Management and Store Sections.

1.2 Organization in O & M Stage

After completion of the project construction works, the Project Construction Office will be re-organized into the Project Operation and Maintenance Office (CABANG) under the same provincial Public Works service. The Project O & M Office will be responsible for operation and maintenance of the irrigation, drainage and road networks down to inlets of tertiary blocks. The operation and maintenance of the tertiary blocks down to the terminal facilities will be entrusted to the farmers' associations and farmers themselves. The organization of the Project O & M Office is shown in Fig. IX-2.

The Office will consist of one head office at Martapura and five sub-offices. All the main and branch offices established in the construction stage will be used as the Project O & M Main Office and sub-offices after completion of the construction work. The main office will consist of two divisions such as Administrative Division and Technical Division. The Administrative Division will consist of four sections, i.e. Accounting Section, Finance Section, Personnel Section and Store Section. The Technical Division will consist of four working sections such as the Design Section, Operation Section, Maintenance Section and Mechanical Section.

The main office will be responsible for the overall activities necessary for proper operation and maintenance of all the project facilities including preparation of overall O & M program, design and construction/supervision of maintenance works, budgeting, training of staff, etc.

Each section of the main office will have the following duties and tasks:

Design Section

(1) survey, planning and design of the maintenance works,

(2) Assistance and advise to farmers' organizations in design of maintenance works of tertiary canals to the terminal facilities, and

(3) collection and analysis of data on the rivers discharge.

Operation Section

(1) estimation of water requirements and preparation of water supply schedule based on the cropping schedule obtained from the water users' association through the sub-offices.

(2) regular contact with sub-offices regarding water supply schedule, and

(3) supply of information on water supply management to the sub-offices.

Maintenance Section

(1) periodical and routine inspection,

(2) preparation of the program for routine and periodical maintenance and emergency repair,

(3) tender for repair works and supervision of the works, and

(4) Assistance and advice to water users' association in maintenance works of tertiary canals down to terminal facilities.

Mechanical Section

(1) management of workshop and O & M equipment,

(2) preparation of operation schedule of O & M equipment,

(3) repair and maintenance of metal works of the project facilities.

As mentioned above, five sub-offices will be established in the project area. The sub-offices will have eleven field offices (Resorts), which are terminal field offices of the Project O & M Office. The duties of the sub-offices are as follows:

(1) collection of information of cropping schedule from the water users' associations and transfer it to the main office,

(2) supply of information on water supply schedule to the water users' associations,

(3) gate operation according to the water supply schedule prepared by the main office, and

(4) maintenance of the project facilities in the commanding area.

(5) Providing periodical consultation to water users' association on operation and maintenance of tertiary canals down to terminal facilities.

The commanding areas, facilities and Kecamatan concerned to the sub-offices are as follows:

Sub-Office	Main Facilities	Commanding area	Kecamatan Concerned
Perjaya	Headworks Headreach	Area directly Commanded by Headreach	Martapura
Bumiharjo	Upper reaches of South Main Canal and Pisang Main Canal	Western part of Sub-Area-II including Pisang area	Bahuga
Sukaharjo	Lower reaches of South Main Canal	Eastern part of Sub-Area-II	Belitang
Muarahaju	Lower reaches of North Main Canal	Eastern part of Sub-Area-I	Cempaka
Redodadi	Upper reaches of North Main Canal	Western part of Sub-Area-I	Buay Madang

2. STAFFING AND EXPATRIATE ASSISTANCE

Number of Staff required in the Project office is estimated paying due attention to the working quantities, implementation method and schedule, and number of tertiary irrigation block based on the similar projects. Staff needed will have to be increased with the progress of the project works. Total number of staff required in the construction stage is estimated to be 220 at maximum, which include administrative staff, engineers, experts and field attendants.

Required number of the staff in the full operation stage of the project will be 204. In addition, considerable number of seasonal employees will be required for the maintenance works. The staffs required during the construction and operation and maintenance stages are shown in Table IX-1 and IX-2 with their specialities.

To cope with severe shortage of experienced personnel in Indonesia, some specialists would have to be engaged from abroad throughout the design and construction stages. The required number of the experts to be invited for both stages are shown in Table IX-3 and IX-4.

3. WATER USERS' ASSOCIATION

Operation and maintenance of the facilities in the tertiary block will be carried out by farmers themselves. Before completion of the construction works of the project facilities, the water users' association should be established under the initiation of each village chief, Camat and Bupati with strong guidance of and consultation with the Project O & M Office and agricultural office. In general, a water users' association will be organized in each village unit consisting of several tertiary blocks. The typical organization chart is shown in Fig. IX-3.

In order to ensure proper water management by the water users' association, Bupati, Camat and village chief will assist and supervise all the activities of the association at their respective levels. The activities of the association will further be supported by the Kabpaten Irrigation Committee, the project office, the Kecamatan Irrigation Section (SEKSI) and the village unit. In particular, the project office will provide full technical guidance and advice in water supply management and maintenance and improvement of the facilities in the tertiary block through the Resorts of the O & M sub-office.

The water users' association will have a board which consists of a Chairman, Treasurer and farmers' representatives. The chairman of the board elected from and by the members will manage the association. The treasurer will be responsible for financial administration. Ulu ulu will carry out water management in the tertiary block, such as preparation of irrigation calendar, handling of canal structures, diverting of scheduled amount of water to the quaternary canals, and supervision of maintenance works, etc. For the assistant of Ulu ulu, the farmers' leaders will be engaged in water management.

The activities of Ulu ulu and the farmers' leaders are important for proper water management at farm level and for the project as well. They are required to have a certain technical knowledge for water supply management of the project as well as at farm level. They will therefore be trained by the staff of the Project office.

Table IX-1 REQUIRED NUMBER OF PROJECT STAFF IN CONSTRUCTION STAGE

Project Staff	Year 1983	'84	'85	'86	'87	'88	'89	'90	'91
Komering-I									
Project Office	1	1	1	1	1	1	1	1	1
Project Manager	1	1	1	1	1	1	1	1	1
Clerk	1	1	1	1	1	1	1	1	1
	2	2	2	2	2	2	2	2	2
Engineering Division									
Civil Eng.	1	1	1	1	1	1	1	1	1
Clerk	1	1	1	1	1	1	1	1	1
Typist	1	1	1	1	1	1	1	1	1
	3	3	3	3	3	3	3	3	3
Design-Section									
Irrigation Eng.	1	1	1	1	1	1	1	1	1
Design Eng.	1	4	7	6	6	5	4	2	1
Junior Design Eng.	0	4	8	8	8	8	8	4	0
Surveyor	0	4	8	8	8	8	8	4	1
Draftsman	2	4	10	10	10	10	10	5	1
Typist	1	2	2	2	2	2	2	1	1
	5	19	36	35	35	34	33	17	5
Construction Section									
Civil Eng.	1	1	1	1	1	1	1	1	1
Construction Eng.	1	2	9	8	8	7	6	6	3
Mechanical Eng.	1	1	1	1	1	1	1	1	0
Electrical Eng.	1	1	1	1	1	1	1	1	0
Building Eng.	1	1	1	1	1	1	1	1	0
Field Supervisor	2	5	20	18	18	15	12	12	5
Draftsman	2	4	4	4	4	4	4	4	0
Typist	1	2	2	2	2	2	2	2	1
	10	17	39	36	36	32	28	28	10
Workshop Section									
Mechanical Eng.	1	1	1	1	1	1	1	1	1
Mechanic	1	2	2	2	2	2	2	2	2
Electrician	1	1	1	1	1	1	1	1	1
Operator	0	0	0	2	5	7	7	7	7
Driver	2	5	10	8	8	8	8	8	8
Typist	1	1	1	1	1	1	1	1	1
	6	10	15	15	18	20	20	20	20

(to be continued)

Project Staff	Year 1983	'84	'85	'86	'87	'88	'89	'90	'91
Operation Section									
Water Officer	0	0	0	1	1	1	1	1	1
Assist. Water Off.	0	0	0	2	2	2	2	4	7
Typist	0	0	0	1	1	1	1	2	2
	0	0	0	4	4	4	4	7	10
Sub-total	26	51	95	95	98	95	90	77	50
Administrative Division									
Administrative Officer	1	1	1	1	1	1	1	1	1
Clerk	1	1	1	1	1	1	1	1	1
Accounting Section									
Accountant	1	1	1	1	1	1	1	1	1
Others	1	2	4	4	4	4	2	1	1
Finance Section									
Finance Officer	1	1	1	1	1	1	1	1	1
Others	1	2	3	3	3	3	2	1	1
Personnel Section									
Personnel Management Off.	1	1	1	1	1	1	1	1	1
Others	1	2	3	3	3	3	2	1	1
Store Section									
Store Keeper	1	1	1	1	1	1	1	1	1
Others	1	2	3	3	3	3	2	1	1
Sub-total	10	14	18	18	18	18	14	10	10
Sub-office and Resort									
Chief	0	0	0	1	2	3	4	5	5
Officer	0	0	0	4	8	12	16	20	25
Waterman (PP Air)	0	0	0	20	40	60	80	100	130
Sub-total	0	0	0	25	50	75	100	125	160
Total	36	65	113	138	166	188	204	212	220

Table IX-2 REQUIRED NUMBER OF PROJECT STAFF IN O & M STAGE

Project Staff	No. of Personnel
1. Project Office	2
(1) Project Manager	1
(2) Secretary/Typist	1
2. Administrative Division	10
(1) Administrative Officer (Chief)	1
(2) Accountant	1
(3) Cashier	1
(4) Finance Officer	1
(5) Personnel Officer	1
(6) Clerks/Typists	3
(7) Store Keeper	2
3. Technical Division	32
(1) Civil Engineer (Chief)	1
(2) Irrigation Engineer	1
(3) Design Engineer	1
(4) Construction Engineer	2
(5) Field Supervisor	3
(6) Mechanical Engineer	1
(7) Mechanic	1
(8) Electrician	1
(9) Operator	5
(10) Driver	8
(11) Water Officer	1
(12) Assist. Water Officer	3
(13) Clerks/Typists	4
4. Sub-Office	160
(1) Sub-office Chief	5
(2) Officer	25
(3) Waterman	130
Total	204

Table IX-3 REQUIRED NUMBER OF FOREIGN CONSULTANTS (Detailed Design Stage)

Speciality	Number of Personnel		
	Headworks & Headreach	Sub-area-I	Sub-area-II
1. Project Director	1	1	1
2. Team Leader	1	1	1
3. Irrigation Planning Engineer	1	1	1
4. Irrigation Design Engineer	3	3	3
5. Civil Engineer	1	-	1
6. Quantity Surveyor	1	2	2
7. Hydraulic Structural Engineer	1	2	1
8. Hydrologist	1	-	1
9. Geologist	1	-	1
10. Soil Mechanical Engineer	1	1	1
11. Mechanical Engineer	1	1	1
12. Construction Planner	1	1	1
13. Topographic Surveyor	2	3	3
14. Other Specialists as required	L.S.	L.S.	L.S.

Table IX-4 REQUIRED NUMBER OF FOREIGN CONSULTANTS (Construction Stage)

Specialist	Number of Personnel				
	Headworks & Headreach	Sub-area-I	Tertiary Develop. (Sub-area-I)	Sub-area-II	Tertiary Develop. (Sub-area-II)
1. Project Director	1	1	-	1	-
2. Team Leader	1	1	-	1	-
3. Construction Engineer	2	1	1	1	1
4. Irrigation Engineer	-	1	1	1	1
5. Design Engineer	1	1	-	1	-
6. On-farm Design Engineer	-	2	2	2	2
7. Equipment Engineer	1	1	-	1	-
8. Quantity Measurement Engineer	1	1	-	1	-
9. Metal Work Engineer	1	1	-	1	-
10. Soil Mechanical Engineer	1	1	-	1	-
11. Foundation Engineer	1	1	-	1	-
12. Procurement Engineer	1	1	-	1	-
13. Topographic Surveyor	-	1	2	1	2
14. Guidance Engineer	1	1	-	1	-
15. Other Specialists as required	L.S.	L.S.	L.S.	L.S.	L.S.

Fig. IX-1 ORGANIZATION OF PROJECT CONSTRUCTION OFFICE

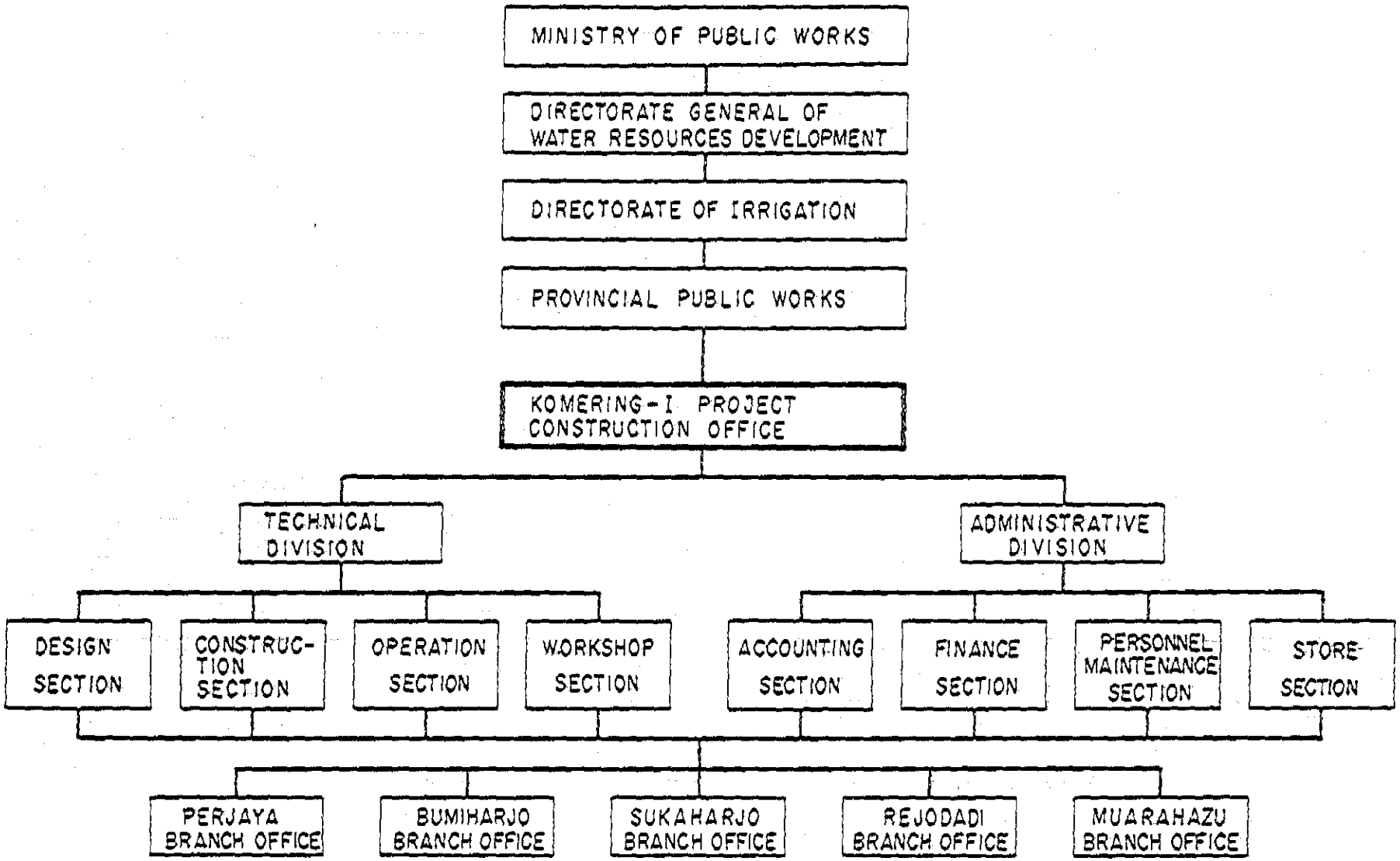


Fig. IX-2 ORGANIZATION OF PROJECT O & M OFFICE (CABANG)

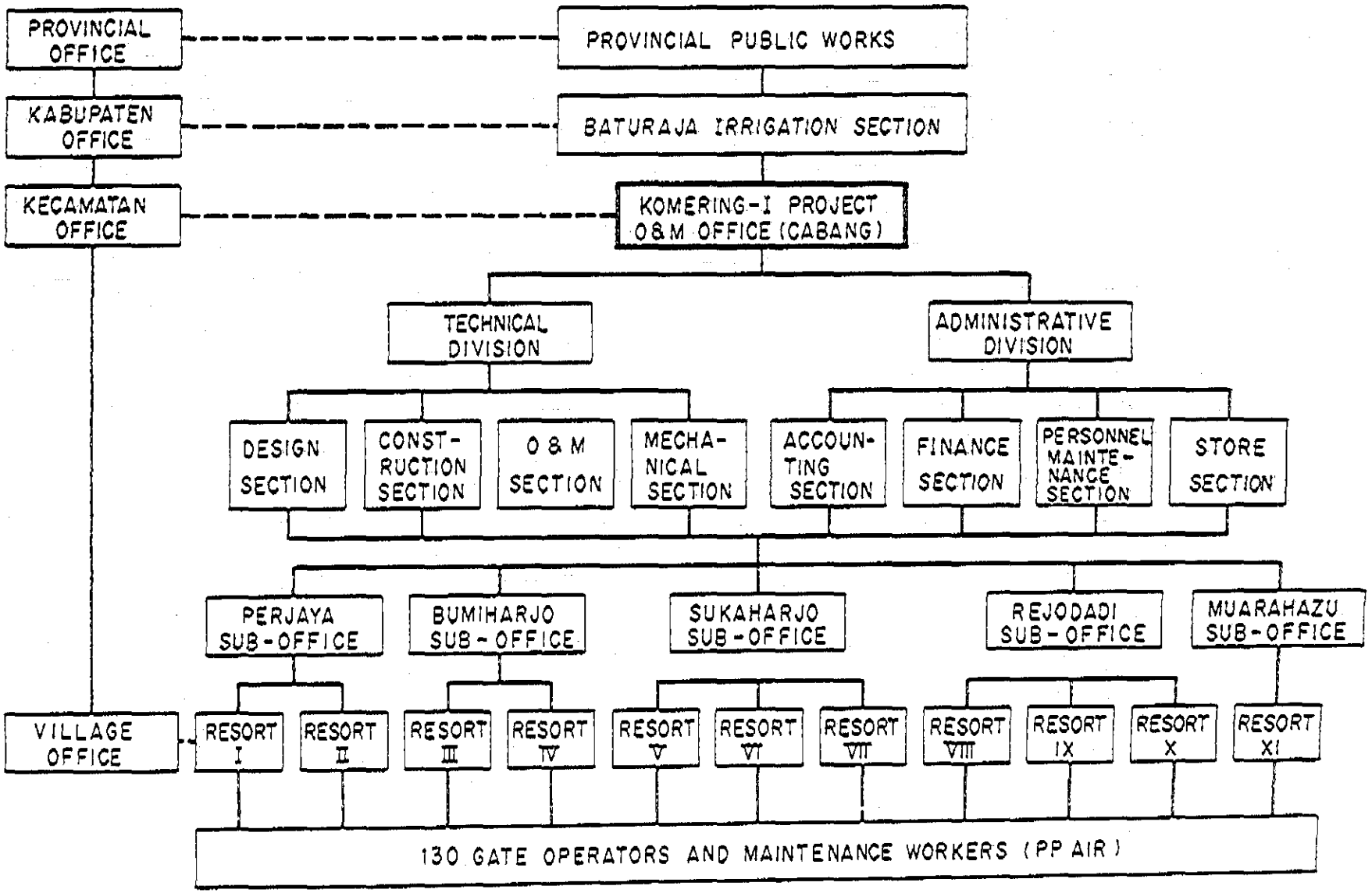
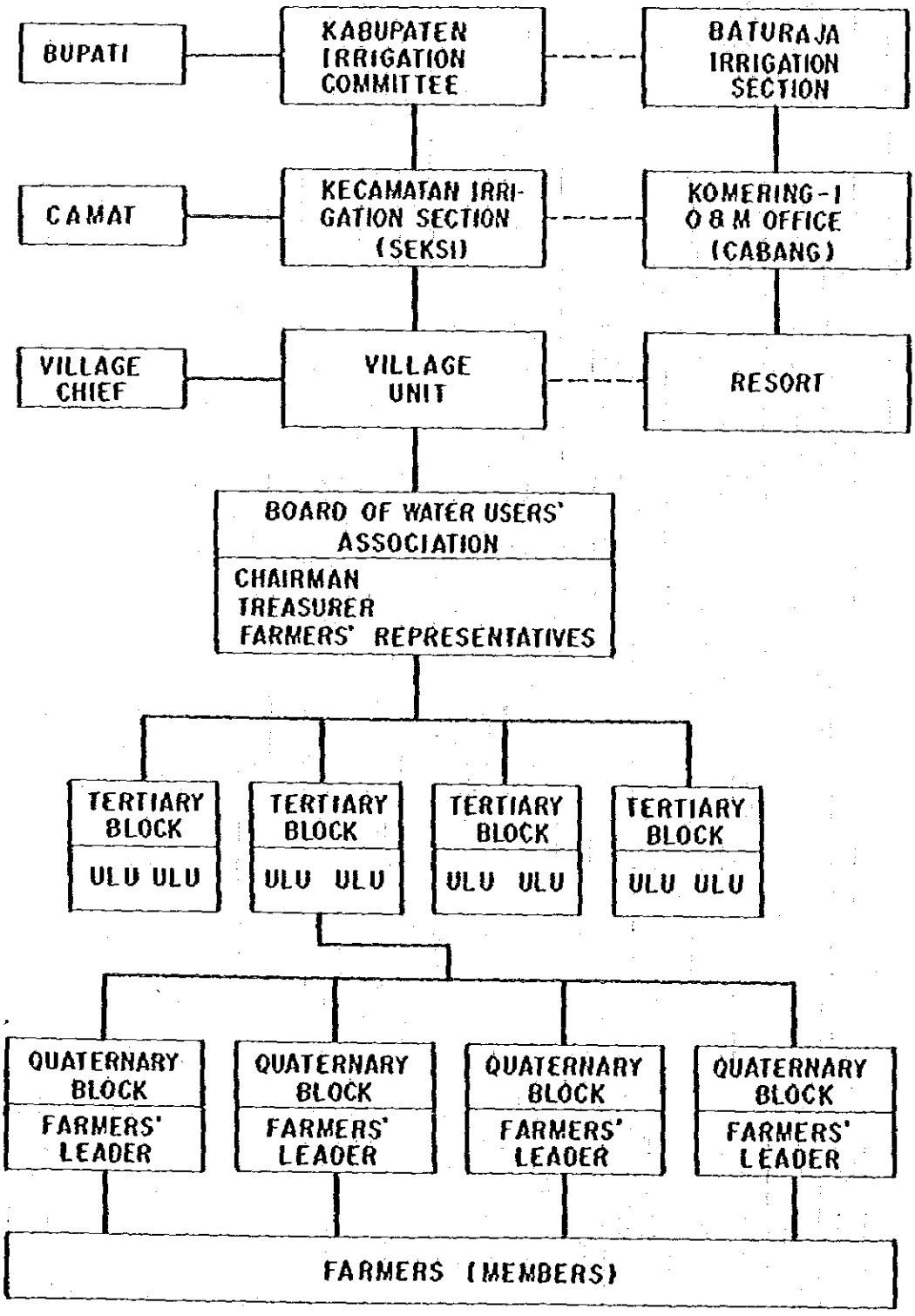


Fig. IX-3 WATER USERS' ASSOCIATION



ANNEX X

COST ESTIMATE

ANNEX - X

COST ESTIMATE

1. CONSTRUCTION COST

1.1 Conditions

The construction cost is estimated based on the following conditions.

(1) The exchange rate used in the estimate is;

US$1=Rp.625

=¥220

(2) Civil engineering works are to be carried out on the contract basis using contractor's own heavy construction machinery and equipment.

(3) Taxes on the construction materials, machinery and equipment to be imported from abroad are exempted from the estimate of construction cost.

(4) The construction cost comprises foreign and local currency portions. The local currency portion is estimated based on the current prices in South Sumatra Province in October 1980 and the data collected from the on-going projects in the province. The foreign currency portion is estimated based on the CIF prices at Palembang referring to the FOB prices of materials, machinery and equipment in Japan in December 1980. The classification of local and foreign currency portions is defined as follows:

Local currency portion

- labor force,
- sand, gravel and wooden materials,
- fuel, oil, etc.,
- inland transportion costs,
- contractors' general expenses and profit,
- expenses of engineering services for local consultant, and
- minor works.

Foreign currency portion

- reinforcement bar and other structural steel,
- cement,
- steel gates, diesel generators, motor and other metal works,
- depreciation costs for heavy construction machinery and equipment,
- vehicles to be required for the construction supervision and O & M equipment for the project operation,
- contractors' general expenses and profit, and
- expenses and fees of engineering services by foreign consultant.

(5) For the construction of the quaternary network, only the costs of materials necessary for the construction of the division boxes and culverts are included in the estimate. The construction works of the quaternary network are to be carried out by local farmers themselves under the guidance of the project office.

(6) Cost for jungle clearing is not included in the construction cost, because this work is considered to be done by transmigrants who will settle before the start of the construction work.

(7) The physical contingency related to the construction quantities, around 10% of the direct costs, is included in the construction cost in view of the preliminary nature of the estimate. The price contingency; 5% per annum for the foreign currency portion and 8% per annum for the local currency portion, is also included in the construction cost.

(8) The associated costs to be financed by the Government, such as the costs for strengthening the extension services, facilities of the water users' association, and improvement of the social infrastructures are not included in the estimate.

1.2 Estimate of Construction Cost

The total construction costs of the project are estimated at US$321 million, which comprise US$122 million equivalent of local currency and US$199 million of foreign currency. The summary and breakdown of the cost estimate are shown in Table X-1 through Table X-15.

The prices of local materials and labour wages used in the estimate and the unit rates for major works are as shown in Table X-16 and X-18 respectively.

1.3 Annual Disbursement Schedule

The annual disbursement schedule is worked out based on the construction time schedule. The details are stated in Table X-3.

Year	Foreign Currency (10^3US$)	Currency (10^3US$)	Total (10^3US$)
1983	2,229	763	2,992
1984	7,212	3,056	10,268
1985	9,292	3,229	12,521
1986	17,743	9,509	27,252
1987	30,695	17,847	48,542
1988	46,360	25,808	72,168
1989	38,715	26,378	65,093
1990	30,217	21,051	51,268
1991	16,899	14,246	31,145
Total	199,362	121,887	321,249

2. ANNUAL OPERATION AND MAINTENANCE COSTS

The annual operation and maintenance costs include the salaries of project administrative and water control staffs, the materials and labor costs for repair and maintenance of project facilities, the costs for operation, repair and maintenance of O & M equipment, and the running costs of project facilities including diesel generators.

The summary of the annual operation and maintenance costs are as shown in Table X-18.

3. REPLACEMENT COSTS

Some of the facilities, especially mechanical and electrical works have shorter useful life than the civil works and are require replacement at a certain time within the project useful life.

The replacement costs and the useful lives of these facilities are listed in Table X-20.

Table X-1 SUMMARY OF CONSTRUCTION COST

	Item	Total	Foreign Currency	Local Currency
		(10^3US$)	(10^3US$)	(10^6Rp.)
1.	Preparatory Works	10,979	7,993	1,866
2.	Ranau Regulating Dam	1,832	1,229	377
3.	Headworks and Headreach	18,854	15,294	2,225
4.	Irrigation Canals and Inspection Roads	64,038	42,584	13,409
5.	Drainage Canals	10,985	6,294	2,932
6.	Tertiary Development	26,684	17,097	5,992
7.	Land Reclamation	31,173	21,235	6,211
8.	Office and Quarters	1,816	-	1,135
	Sub-total	166,361	111,726	34,147
9.	Land Acquisition	3,431	-	2,144
10.	O & M Equipment	4,888	4,490	249
11.	Administration Expenses	2,534	-	1,584
12.	Engineering Services	16,072	14,318	1,096
13.	Physical Contingency	15,379	11,173	3,629
	Sub-total	43,904	29,981	8,702
	Total	210,265	141,706	42,849
14.	Price Contingency	110,984	57,656	33,330
	GRAND TOTAL	321,249	199,362	76,179

Table X-2 SUMMARY OF CONSTRUCTION COST FOR EACH WORK DIVISION

Unit : FC : 10^3US$
LC : 10^6Rp.

Item	Total		Headworks & Headreach		Sub-area-I/1		Tertiary Development/2 (Sub-area-I)		Sub-area-II/3		Tertiary Development/4 (Sub-area-II)	
	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC
1. Preparatory Works	7,993	1,866	3,387	364	1,865	619	-	-	2,714	883	-	-
2. Kanau Regulating Dam	1,229	377	-	-	-	-	-	-	1,229	377	-	-
3. Headworks and Headreach	15,294	2,225	15,294	2,225	-	-	-	-	-	-	-	-
4. Irrigation Canals and Inspection Roads	42,584	13,409	-	-	17,843	5,581	-	-	24,741	7,828	-	-
5. Drainage Canals	6,294	2,932	-	-	4,185	1,828	-	-	2,109	1,104	-	-
6. Tertiary Development	17,097	5,992	-	-	871	310	7,183	2,557	994	343	8,049	2,782
7. Land Reclamation	21,235	6,211	-	-	7,210	2,116	-	-	14,025	4,095	-	-
8. Office and Quarters	-	1,135	-	1,135	-	-	-	-	-	-	-	-
Sub-total	111,726	34,147	18,681	3,724	31,974	10,454	7,183	2,557	45,839	14,630	8,049	2,782
9. Land Acquisition	-	2,144	-	179	-	834	-	-	-	1,131	-	-
10. O & M Equipment	4,490	249	3,760	95	730	154	-	-	-	-	-	-
11. Administration Expenses	-	1,584	-	938	-	-	-	-	-	646	-	-
12. Engineering Services	14,318	1,096	3,919	300	4,222	323	1,098	84	3,981	305	1,098	84
13. Physical Contingency	11,173	3,629	1,868	390	3,197	1,129	718	256	4,584	1,576	805	278
Sub-total	29,981	8,702	9,547	1,902	8,149	2,440	1,816	340	8,565	3,658	1,903	362
Total	141,706	42,849	28,228	5,626	40,123	12,894	8,999	2,897	54,404	18,288	9,952	3,144
14. Price Contingency	57,656	33,330	7,680	2,465	15,306	8,725	4,306	2,474	24,866	16,514	6,598	3,152
GRAND TOTAL	199,362	76,179	35,908	8,091	55,429	21,619	13,305	5,371	79,270	34,802	15,450	6,296

/1 ; Tertiary development area: 2,000 ha
/2 ; Tertiary development area: 16,500 ha
/3 ; Tertiary development area: 2,000 ha
/4 ; Tertiary development area: 16,200 ha

Table X-3 ANNUAL DISBURSEMENT SCHEDULE OF CONSTRUCTION COST

Unit: FC: 10^3US$
LC: 10^6Rp.

Description	Total		1983		1984		1985		1986		1987		1988		1989		1990		1991	
	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC
1. Headworks and Headreach																				
1.1 Direct Construction Cost	18,681	3,726	-	227	1,919	1,090	4,239	493	3,548	703	3,193	623	5,782	588	-	-	-	-	-	-
1.2 Land Acquisition	-	179	-	-	-	36	-	54	-	53	-	36	-	-	-	-	-	-	-	-
1.3 O & M Equipment	3,760	95	1,128	29	2,632	66	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1.4 Administration Expenses	-	938	-	63	-	96	-	171	-	186	-	205	-	217	-	-	-	-	-	-
1.5 Engineering Services	3,919	300	894	65	523	45	500	40	751	55	751	55	500	40	-	-	-	-	-	-
1.6 Physical Contingency	1,868	390	-	23	192	113	425	54	355	75	319	66	578	59	-	-	-	-	-	-
Sub-total	28,228	5,626	2,022	409	5,266	1,446	5,164	812	4,654	1,072	4,263	985	6,860	904	-	-	-	-	-	-
1.7 Price Contingency	7,680	2,465	207	68	830	376	1,113	293	1,286	503	1,450	578	2,793	645	-	-	-	-	-	-
Total	35,908	8,091	2,229	477	6,096	1,822	6,277	1,105	5,940	1,575	5,713	1,563	9,653	1,549	-	-	-	-	-	-
2. Sub-area-I (18,500 ha)																				
2.1 Direct Construction Cost	31,974	10,454	-	-	-	-	933	310	5,315	1,711	8,343	2,715	8,210	2,683	4,933	1,663	4,240	1,372	-	-
2.2 Land Acquisition	-	834	-	-	-	-	-	167	-	167	-	167	-	167	-	166	-	-	-	-
2.3 O & M Equipment	730	154	-	-	-	-	219	46	219	46	146	31	146	31	-	-	-	-	-	-
2.4 Engineering Services	4,222	323	-	-	964	70	642	55	785	60	523	40	523	40	523	40	262	18	-	-
2.5 Physical Contingency	3,197	1,129	-	-	-	-	93	48	532	188	834	288	821	285	493	183	424	137	-	-
Sub-total	40,123	12,894	-	-	964	70	1,887	626	6,851	2,172	9,846	3,241	9,700	3,206	5,949	2,052	4,926	1,527	-	-
2.6 Price Contingency	15,306	8,725	-	-	152	18	407	220	1,883	1,019	3,346	1,902	3,949	2,289	2,840	1,746	2,716	1,525	-	-
Total	55,429	21,619	-	-	1,116	88	2,294	852	8,744	3,191	13,195	5,143	13,649	5,495	8,789	3,798	7,642	3,052	-	-
3. Tertiary Development, Sub-area-I																				
3.1 Direct Construction Cost	7,183	2,557	-	-	-	-	-	-	-	-	-	-	2,155	767	2,873	1,023	2,155	767	-	-
3.2 Engineering Services	1,098	84	-	-	-	-	-	-	-	-	-	-	329	25	440	34	329	25	-	-
3.3 Physical Contingency	718	256	-	-	-	-	-	-	-	-	-	-	216	77	287	102	215	77	-	-
Sub-total	8,999	2,897	-	-	-	-	-	-	-	-	-	-	2,700	869	3,600	1,159	2,699	869	-	-
3.4 Price Contingency	4,306	2,474	-	-	-	-	-	-	-	-	-	-	1,099	620	1,719	986	1,488	868	-	-
Total	13,305	5,371	-	-	-	-	-	-	-	-	-	-	3,799	1,489	5,319	2,145	4,187	1,737	-	-
4. Sub-area-II (18,200 ha)																				
4.1 Direct Construction Cost	45,839	14,630	-	-	-	-	-	-	1,371	442	7,542	2,286	11,761	3,749	11,971	3,857	6,702	2,203	6,492	2,093
4.2 Land Acquisition	-	1,131	-	-	-	-	-	-	-	227	-	226	-	226	-	226	-	226	-	-
4.3 Administration Expenses	-	646	-	-	-	-	-	-	-	-	-	-	-	-	-	221	-	216	-	209
4.4 Engineering Services	3,981	305	-	-	-	-	593	45	889	65	500	40	750	60	500	40	500	40	249	15
4.5 Physical Contingency	4,584	1,576	-	-	-	-	-	-	137	67	754	251	1,176	398	1,197	408	670	243	649	209
Sub-total	54,404	18,288	-	-	-	-	593	45	2,397	801	8,796	2,803	13,687	4,433	13,668	4,752	7,872	2,928	7,390	2,526
4.6 Price Contingency	24,866	16,514	-	-	-	-	128	16	662	376	3,991	1,642	5,573	3,164	6,526	4,044	4,340	2,925	4,648	3,344
Total	79,270	34,802	-	-	-	-	721	61	3,059	1,177	11,787	4,448	19,259	7,597	20,194	8,796	12,212	5,853	12,038	6,870
5. Tertiary Development, Sub-area-II																				
5.1 Direct Construction Cost	8,049	2,782	-	-	-	-	-	-	-	-	-	-	-	-	2,415	835	3,220	1,113	2,414	834
5.2 Engineering Services	1,098	84	-	-	-	-	-	-	-	-	-	-	-	-	330	25	439	34	329	25
5.3 Physical Contingency	805	278	-	-	-	-	-	-	-	-	-	-	-	-	242	84	322	111	241	83
Sub-total	9,952	3,144	-	-	-	-	-	-	-	-	-	-	-	-	2,987	944	3,981	1,258	2,984	942
5.4 Price Contingency	5,498	3,152	-	-	-	-	-	-	-	-	-	-	-	-	1,426	803	2,195	1,257	1,877	1,092
Total	15,450	6,296	-	-	-	-	-	-	-	-	-	-	-	-	4,413	1,747	6,176	2,515	4,861	2,034
GRAND TOTAL	199,362	76,179	2,229	477	7,212	1,910	9,292	2,018	17,743	5,943	30,695	11,154	46,360	16,130	38,715	16,486	30,217	13,157	16,899	8,904

Table X-4 BREAKDOWN OF DIRECT CONSTRUCTION COST FOR RANAU REGULATING DAM

Works	Unit	Q'ty	Foreign Currency (US$)	Local Currency (10^3Rp)
1. Preparatory Works		L.S.	246,100	75,950
2. Expansion Works of River			721,000	265,450
2.1 Site clearing	ha	5	2,600	2,750
2.2 Excavation	m^3	184,200	718,400	262,700
3. Dam			507,900	111,600
3.1 Site clearing	ha	3	1,600	500
3.2 Excavation	m^3	2,900	11,300	4,200
3.3 Concrete works	m^3	4,600	247,200	46,300
3.4 Gate	t	12.5	163,100	24,000
3.5 Operation house	m^2	150	-	18,000
3.6 Miscellaneous		L.S.	84,700	18,600
TOTAL			1,475,000	453,000
			(US$ 2,199,800)	

Table X-5(1) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR HEADWORKS AND HEADREACH

Works	Unit	Q'ty	Foreign Currency (US$)	Local Currency (10^3Rp)
1. Preparatory Works		L.S.	3,386,800	363,700
2. Headworks			12,998,000	1,616,000
2.1 Weir			7,288,700	888,200
2.1.1 Site clearing and stripping	ha	4	2,100	600
2.1.2 Excavation	m^3	54,300	71,600	29,000
2.1.3 Backfill	m^3	5,100	3,000	2,900
2.1.4 Concrete works	m^3	38,100	3,966,500	458,100
2.1.5 Masonry works	m^3	3,200	25,700	20,100
2.1.6 Gabion	m^2	11,600	-	124,600
2.1.7 Concrete pile ϕ400	m	4,700	170,600	13,400
2.1.8 Sheet pile	m^2	2,700	139,000	8,200
2.1.9 Structural steel works	t	202	303,400	13,400
2.1.10 Metal works	t	180	1,504,900	20,300
2.1.11 Operation house	m^2	340	-	40,800
2.1.12 Electric facilities		L.S.	371,200	43,800
2.1.13 Miscellaneous		L.S.	730,700	113,000
2.2 Intake structure			3,227,200	180,800
2.2.1 Site clearing and stripping	ha	4.0	2,100	500
2.2.2 Excavation	m^3	19,800	19,400	7,800
2.2.3 Backfill	m^3	3,800	2,200	2,200
2.2.4 Concrete works	m^3	8,580	1,828,800	136,200
2.2.5 Structural steel works	t	61	92,300	4,000
2.2.6 Metal works	t	117	989,200	13,300
2.2.7 Miscellaneous		L.S.	293,200	16,800

(to be continued)

Table X-5(2) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR HEADWORKS AND HEADREACH

Works	Unit	Q'ty	Foreign Currency (US$)	Local Currency (10^3Rp)
2.3 Driving channel			802,900	321,200
2.3.1 Site clearing and stripping	ha	9	4,700	1,400
2.3.2 Excavation	m^3	188,700	184,900	74,400
2.3.3 Earthfill	m^3	25,000	18,300	4,900
2.3.4 Concrete lining	m^3	10,200	490,300	198,600
2.3.5 Miscellaneous		L.S.	104,700	41,900
2.4 Settling basin			1,679,200	225,800
2.4.1 Site clearing and stripping	ha	2	1,100	300
2.4.2 Excavation	m^3	28,600	28,000	11,300
2.4.3 Earthfill	m^3	1,500	1,100	300
2.4.4 Backfill	m^3	2,400	1,400	1,400
2.4.5 Concrete works	m^3	6,580	1,009,100	110,200
2.4.6 Metal works	t	33	430,400	63,200
2.4.7 Operation house	m^2	100	-	12,000
2.4.8 Miscellaneous		L.S.	208,100	27,100
3. Headreach (8 km)			2,296,200	609,300
3.1 Civil works of headreach			1,106,400	401,300
3.1.1 Site clearing and stripping	ha	42.4	44,100	12,700
3.1.2 Excavation	m^3	936,000	861,000	348,200
3.1.3 Earthfill	m^3	74,900	54,700	14,600
3.1.4 Concrete lining	m^3	130	62,000	800
3.1.5 Related structure				
- Turnout	nos.	5	66,800	13,200
- Bridge	no.	1	51,600	5,700
- Crossdrain	no.	1	22,000	6,100

(to be continued)

Table X-5(3) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR HEADWORKS AND HEADREACH

Works	Unit	Q'ty	Foreign Currency (US$)	Local Currency (10^3Rp)
3.2 Main inspection road			313,400	99,900
3.2.1 Site clearing and stripping	ha	14.6	7,600	2,200
3.2.2 Excavation	m^3	11,700	10,800	4,400
3.2.3 Earthfill	m^3	49,000	35,800	9,600
3.2.4 Gravel pavement	m^2	74,690	259,200	83,700
3.3 Bifurcation structure			876,400	108,100
3.3.1 Site clearing and stripping	ha	0.40	200	100
3.3.2 Excavation	m^3	5,161	900	2,100
3.3.3 Backfill	m^3	754	400	400
3.3.4 Concrete works	m^3	2,961	495,100	50,700
3.3.5 Metal works	t	27.6	233,700	31,800
3.3.6 Operation house	m^2	50	-	6,000
3.3.7 Miscellaneous		L.S.	146,100	17,000
TOTAL			18,681,000	2,589,000
			(US$22,823,400)	

Table X-6(1) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR SUB-AREA-I (18,500 ha)

Works	Unit	Q'ty	Foreign Currency (US$)	Local Currency (10^3Rp)
1. Preparatory Works		L.S.	1,864,500	619,200
2. Irrigation Canals and Inspection Roads			17,842,500	5,581,000
2.1 Main canal and main inspection road (50 km)			10,573,200	3,005,600
Main canal			(7,654,200)	(2,059,700)
2.1.1 Site clearing and stripping	ha	117	60,900	17,600
2.1.2 Excavation	m^3	2,555,000	2,350,600	950,500
2.1.3 Earthfill	m^3	870,000	1,350,000	408,900
2.1.4 Concrete lining	m^3	9,600	461,100	61,300
2.1.5 Related structure				
- Turnout	nos.	35	334,600	65,700
- Check gate	nos.	15	1,824,200	265,900
- Spillway and wasteway	nos.	7	341,500	68,300
- Crossdrain	nos.	37	493,300	173,300
- Bridge	nos.	2	169,500	19,300
- Aqueduct	no.	1	268,500	28,900
Main inspection road			(2,919,000)	(945,900)
2.1.6 Site clearing and stripping	ha	75	39,000	11,300
2.1.7 Excavation	m^3	325,000	299,000	120,900
2.1.8 Earthfill	m^3	750,000	1,245,000	382,500
2.1.9 Gravel pavement	m^2	385,000	1,336,000	431,200
2.2 Secondary canal and Secondary inspection road (108 km)			7,269,300	2,395,400
Secondary canal			(5,399,000)	(1,782,700)
2.2.1 Site clearing and stripping	ha	76	219,100	121,500
2.2.2 Excavation	m^3	714,000	442,700	245,600
2.2.3 Earthfill	m^3	1,767,000	1,289,900	344,600
2.2.4 Concrete lining	m^3	31,000	1,750,500	706,700

(to be continued)

Table X-6(2) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR SUB-AREA-I (18,500 ha)

Works	Unit	Q'ty	Foreign Currency) (US$)	Local Currency (10^3Rp)
2.2.5 Related structure				
- Turnout	nos.	188	646,900	161,100
- Check gate	nos.	82	844,100	154,800
- Spillway and wasteway	nos.	30	57,000	9,000
- Crossdrain	nos.	10	62,300	20,300
- Drop	nos.	37	86,500	19,100
Secondary inspection road			(1,870,300)	(612,700)
2.2.6 Site clearing and stripping	ha	76	78,600	22,700
2.2.7 Excavation	m^3	353,300	219,100	121,500
2.2.8 Earthfill	m^3	1,177,800	859,800	229,700
2.2.9 Laterite pavement	m^2	594,000	712,800	238,800
2.3 Operation house	m^2	1,500	-	180,000
3. Drainage Canals			4,185,200	1,827,900
3.1 Main drain (180 km)			2,751,600	1,070,600
3.1.1 Site clearing and rehabilitation	ha	370	328,300	105,100
3.1.2 Excavation	m^3	2,580,000	2,373,600	959,800
3.1.3 Related structure				
- Bridge	nos.	2	49,700	5,700
3.2 Secondary drain (118 km)			1,433,600	757,300
3.2.1 Site clearing and stripping	ha	51	45,200	14,500
3.2.2 Excavation	m^3	1,497,000	928,100	515,000
3.2.3 Related structure				
- Drainage culvert	nos.	38	315,900	113,800
- Drainage drop	nos.	76	144,400	114,000

(to be continued)

Table X-6(3) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR SUB-AREA-I (18,500 ha)

Works	Unit	Q'ty	Foreign Currency (US$)	Local Currency (10^3Rp)
4. Tertiary Development			8,054,400	2,867,100
4.1 Tertiary canal and tertiary inspection road(407 km)			4,748,400	1,355,200
Tertiary canal			(3,151,900)	(870,700)
4.1.1 Site clearing and stripping	ha	326	169,500	48,900
4.1.2 Excavation	m^3	264,550	164,000	91,000
4.1.3 Earthfill	m^3	1,302,400	1,797,300	537,900
4.1.4 Related structure				
- Tertiary box	nos.	1,270	433,100	65,900
- Culvert	nos.	370	131,700	23,900
- Drop	nos.	1,180	405,900	96,500
- Crossdrain	nos.	60	50,400	6,600
Tertiary inspection road			(1,596,500)	(484,500)
4.1.5 Site clearing and stripping	ha	259	134,700	38,900
4.1.6 Earthfill	m^3	880,600	1,461,800	445,600
4.2 Tertiary drain (444 km)			1,349,500	537,200
4.2.1 Site clearing and stripping	ha	355	184,600	53,300
4.2.2 Excavation	m^3	1,110,000	688,200	381,800
4.2.3 Related structure				
- Drainage culvert		370	198,000	35,800
- Drainage drop		540	278,700	66,300
4.3 Quaternary system		L.S.	1,956,500	974,700
5. Land Reclamation			7,210,400	2,115,800
5.1 Land clearing	ha	6,010	2,530,900	771,100
5.2 Land levelling	m^3	3,585,840	4,679,500	1,344,700
TOTAL			39,157,000	13,011,000
			(US$59,974,600)	

Table X-7(1) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR SUB-AREA-II (18,200 ha)

Works	Unit	Q'ty	Foreign Currency (US$)	Local Currency (10^3Rp)
1. Preparatory Works		L.S.	2,495,400	807,300
2. Irrigation Canals and Inspection Roads			24,740,700	7,828,300
2.1 Main canal and main inspection road (85 km)			16,836,700	4,905,900
Main canals			(11,435,600)	(3,134,400)
2.1.1 Site clearing and stripping	ha	191	99,300	28,700
2.1.2 Excavation	m^3	3,503,000	3,222,800	1,303,100
2.1.3 Earthfill	m^3	2,046,000	3,069,000	961,600
2.1.4 Concrete lining	m^3	14,700	706,100	93,800
2.1.5 Related structure				
- Turnout	nos.	54	432,300	84,700
- Check gate	nos.	23	2,487,400	369,400
- Spillway and wasteway	nos.	11	484,200	98,800
- Crossdrain	nos.	32	416,000	145,600
- Bridge	nos.	4	237,800	24,300
- Aqueduct	no.	1	280,700	24,400
Main inspection road			(5,401,100)	(1,771,500)
2.1.6 Site clearing and stripping	ha	127	66,100	19,100
2.1.7 Excavation	m^3	875,000	805,000	325,500
2.1.8 Earthfill	m^3	1,364,000	2,264,200	695,600
2.1.9 Gravel pavement	m^2	652,960	2,265,800	731,300
2.2 Secondary canal and secondary inspection road (129 km)			7,904,000	2,700,400
Secondary canals			(5,765,800)	(1,999,700)
2.2.1 Site clearing and stripping	ha	65	67,100	19,400
2.2.2 Excavation	m^3	1,811,000	732,200	406,300

(to be continued)

Table X-7(2) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR SUB-AREA-II (18,200 ha)

Works	Unit	Q'ty	Foreign Currency (US$)	Local Currency (10^3Rp)
2.2.3 Earthfill	m^3	1,954,000	1,426,400	381,000
2.2.4 Concrete lining	m^3	34,000	1,936,000	821,800
2.2.5 Related structure				
- Turnout	nos.	221	691,900	175,100
- Check gate	nos.	95	608,100	123,200
- Spillway and wasteway	nos.	40	76,000	12,000
- Crossdrain	nos.	16	99,700	32,500
- Drop	nos.	55	128,400	28,400
Secondary inspection road			(2,138,200)	(700,700)
2.2.6 Site clearing and stripping	ha	90	93,900	27,100
2.2.7 Excavation	m^3	390,700	242,200	254,000
2.2.8 Earthfill	m^3	1,302,300	950,700	134,400
2.2.9 Laterite pavement	m^2	709,500	851,400	285,200
2.3 Operation house	m^2	1,850	-	222,000
3. Drainage Canals			2,108,900	1,104,200
3.1 Secondary drain (191 km)			2,108,900	1,104,200
3.1.1 Site clearing and stripping	ha	82	72,800	23,300
3.1.2 Excavation	m^3	2,145,000	1,329,900	737,900
3.1.3 Related Structure				
- Drainage culvert	nos.	59	470,600	157,000
- Drainage drop	nos.	124	235,600	186,000

(to be continued)

Table X-7(3) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR SUB-AREA-II (18,200 ha)

Works	Unit	Q'ty	Foreign Currency (US$)	Local Currency (10^3Rp)
4. Tertiary Development			9,042,900	3,124,400
4.1 Tertiary canal and tertiary inspection road	(473 km)		5,545,300	1,524,100
Tertiary canal			(3,862,500)	(1,073,800)
4.1.1 Site clearing and stripping	ha	378	196,600	56,700
4.1.2 Excavation	m^3	307,500	190,700	105,800
4.1.3 Earthfill	m^3	1,513,600	2,225,000	672,100
4.1.4 Related structure				
- Tertiary box	nos.	1,360	463,800	70,600
- Culvert	nos.	380	135,200	24,500
- Drop	nos.	1,600	550,400	130,900
- Crossdrain	nos.	120	100,800	13,200
Tertiary inspection road			(1,682,800)	(450,300)
4.1.5 Site clearing and stripping	ha	273	142,000	38,200
4.1.6 Earthfill	m^3	928,200	1,540,800	412,100
4.2. Tertiary drain (510 km)			1,509,500	609,500
4.2.1 Site clearing and stripping	ha	408	212,200	61,200
4.2.2 Excavation	m^3	1,275,000	790,500	438,600
4.2.3 Related structure				
- Drainage culvert	nos.	360	192,000	34,800
- Drainage drop	nos.	610	314,800	74,900
4.3 Quaternary system		L.S.	1,988,100	990,800

(to be continued)

Table X-7(4) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR SUB-AREA-II (18,200 ha)

Works	Unit	Q'ty	Foreign Currency (US$)	Local Currency (10^3Rp)
5. Land Reclamation			14,025,100	4,094,800
5.1 Land clearing	ha	10,320	4,346,000	1,324,100
5.2 Land levelling	m^3	7,388,640	9,679,100	2,770,700
TOTAL			52,413,000	16,959,000
			(US$ 79,547,400)	

Table X-8 BREAKDOWN OF DIRECT CONSTRUCTION COST OF OFFICE AND QUARTERS

Description	Unit	Q'ty	Local Currency
			(10^3Rp)
1. Main Office	m^2	2,000	240,000
2. Branch Office	m^2	500	50,000
3. Repair Shop	m^2	500	30,000
4. Store House	m^2	5,000	300,000
5. Quarters	m^2	3,100	310,000
6. Motor Pool	m^2	15,000	100,000
7. Land Prepation for Office Yard including Fencing, etc.	m^2	L.S.	105,000
TOTAL			1,135,000
			(US$ 1,816,000)

Table X-9 COST ESTIMATE OF LAND ACQUISITION

Description	Unit	Q'ty	Amount
			(10^3Rp)
1. Ranau Regulating Dam	ha	5	4,000
2. Headworks and Headreach			143,500
2.1 Headworks	ha	17	25,500
2.2 Headreach	ha	72	118,000
3. Sub-area I			834,600
3.1 Irrigation canal	ha	193	386,000
3.2 Drainage canal	ha	90	108,000
3.3 Inspection road	ha	151	226,500
3.4 Miscellaneous		L.S.	114,100
4. Sub-area II			1,126,700
4.1 Irrigation canal	ha	256	512,000
4.2 Drainage canal	ha	82	98,400
4.3 Inspection road	ha	219	328,500
4.4 Miscellaneous		L.S.	187,800
5. Office and Quarters	ha	23	35,200
TOTAL			2,144,000
			(US$ 3,430,400)

Table X-10 PROCUREMENT COST OF MAJOR EQUIPMENT FOR OPERATION AND MAINTENANCE

Item No.	Equipment	Unit Price (US$)	Required No.	Amount (US$)
I.	VEHICLE AND EQUIPMENT			
1.	Dragline, 0.8 m^3	133,000	2	266,000
2.	Backhoe, 0.6 m^3	97,000	6	582,000
3.	Backhoe, 0.3 m^3	45,000	4	180,000
4.	Bulldozer, 21 ton	155,000	2	310,000
5.	Bulldozer, 11 ton	72,000	4	288,000
6.	Dozer shovel, 1.4 m^3	33,000	2	66,000
7.	Wheel loader, 1.0 m^3	41,000	2	82,000
8.	Motor grader, 11 ton	80,000	2	160,000
9.	Water tanker, 5 m^3	44,000	3	132,000
10.	Tire roller, 8-10 ton	35,000	2	70,000
11.	Tamper, 80 kg	1,300	10	13,000
12.	Soil compactor, 90 kg	1,200	10	12,000
13.	Portable concrete mixer, 0.2 m^2	1,300	3	3,900
14.	Concrete vibrator, ϕ45	500	6	3,000
15.	Submersible pump, ϕ150	1,600	5	8,000
16.	Generator, 10 kW	500	4	2,000
17.	Trailer truck, 30 ton	66,000	2	132,000
18.	Dump truck, 11 ton	43,000	4	172,000
19.	Dump truck, 2 ton	9,800	6	58,800
20.	Cargo truck w/crane, 8 ton	43,000	4	172,000
21.	Cargo truck w/crane, 2 ton	13,000	6	78,000
22.	Ordinary truck, 6 ton	20,000	3	60,000
23.	Truck, 1 ton pick-up type	6,500	10	65,000
24.	Jeep, four wheel drive	12,000	10	120,000
25.	Sedan, 6 persons	13,000	3	39,000
26.	Repair shop tools		L.S.	120,000
27.	Spareparts (20% of the above)		L.S.	645,300
II.	TELECOMMUNICATION SYSTEM		1 set	1,048,000
	TOTAL			4,888,000

Table X-11 ADMINISTRATION EXPENSES
(Construction Stage)

(Unit: 10^3Rp)

Year	Staff/1 Salary	Labor Wage	Office Expenses	Equipment Running Cost	Other Related Cost	Total
1983	41,000	1,600	4,800	10,000	5,600	63,000
1984	64,000	6,400	7,200	10,000	8,400	96,000
1985	106,000	14,400	12,000	23,000	15,600	171,000
1986	121,000	12,800	12,000	23,000	17,200	186,000
1987	139,000	12,800	12,000	23,000	18,200	205,000
1988	151,000	11,200	12,000	23,000	19,800	217,000
1989	157,000	9,600	11,400	23,000	20,000	221.000
1990	157,000	6,400	9,600	23,000	20,000	216,000
1991	156,000	3,200	7,200	23,000	19,600	209,000
TOTAL	1,092,000	78,400	88,200	181,000	144,400	1,584,000

/1: Refer to Table X-12.

Table X-12 STAFF SALARY FOR THE PROJECT OFFICE

(Construction Stage)

Year	Grade I		Grade II		Grade III		Grade IV		Grade V		Total Amount
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(10^3Rp)
1983	1	1,800	9	10,800	7	6,720	8	5,760	28	15,120	40,200 (41,000)
1984	1	1,800	9	10,800	12	11,520	26	18,720	39	21,060	63,900 (64,000)
1985	1	1,800	9	10,800	23	22,080	57	41,040	56	30,240	105,960 (106,000)
1986	1	1,800	11	13,200	21	20,160	62	44,640	76	41,040	120,840 (121,000)
1987	1	1,800	12	14,400	21	20,160	69	49,680	97	52,380	138,420 (139,000)
1988	1	1,800	13	15,600	19	18,240	72	51,840	116	62,640	150,120 (151,000)
1989	1	1,800	14	16,800	16	15,360	70	50,400	134	72,360	156,720 (157,000)
1990	1	1,800	15	18,000	14	13,440	69	49,680	145	73,300	156,220 (157,000)
1991	1	1,800	15	18,000	6	5,760	62	44,640	158	85,320	155,520 (156,000)
									TOTAL		1,087,900 (1,092,000)

Note: Grade I ; Project Manager, Rp 150,000/month
Grade II ; Chief of Division and Section, Rp 100,000/month
Grade III ; Engineer and Administrative Officer, Rp 80,000/month
Grade IV ; Assistant Engineer and Assistant Officer, Rp 60,000/month
Grade V ; Draftsman, Typist, Gate Keeper, Rp 45,000/month
(1) ; No. of required staff
(2) ; Total annual salary

Table X-13 COST ESTIMATE OF ENGINEERING SERVICES
(1980 Price Level)

(Unit: US$)

Item	Total		Headworks & Headreach		Sub-area-I		Tertiary D. (Sub-area-I)		Sub-area-II /1		Tertiary D. (Sub-area-II)	
	Q'ty	Amount	Q'ty	Amount	Q'ty	Amount	Q'ty	Amount	Q'ty	Amount	Q'ty	Amount
1. Aero Photo Mapping	L.S.	300,000	L.S.	300,000								
2. Detailed Design												
2.1 Remuneration /2	340 M/M	3,060,000	90 M/M	810,000	130 M/M	1,170,000			120 M/M	1,080,000		
2.2 Air freight	70 Trips	122,500	22 Trips	38,500	26 Trips	45,500			22 Trips	38,500		
2.3 Documentation	L.S.	105,000	L.S.	25,000	L.S.	40,000			L.S.	40,000		
2.4 Other related cost	L.S.	918,000	L.S.	243,000	L.S.	351,000			L.S.	324,000		
Sub-total		4,205,500		1,116,500		1,606,500				1,482,500		
3. Construction Supervision												
3.1 Remuneration /2	800 M/M	7,200,000	210 M/M	1,890,000	220 M/M	1,980,000	80 M/M	720,000	210 M/M	1,890,000	80 M/M	720,000
3.2 Air freight	94 Trips	164,500	26 Trips	45,500	24 Trips	42,000	10 Trips	17,500	24 Trips	42,000	10 Trips	17,500
3.3 Other related cost	L.S.	2,448,000	L.S.	567,000	L.S.	594,000	L.S.	360,000	L.S.	567,000	L.S.	360,000
Sub-total		9,812,500		2,502,500		2,616,000		1,097,500		2,499,000		1,097,500
TOTAL		14,318,000		3,919,000		4,222,500		1,097,500		3,981,500		1,097,500

/1: including Ranau regulating dam.
/2: refer to Table X-14.
/3: refer to Table X-15.

Table X-14 ASSIGNMENT SCHEDULE OF FOREIGN CONSULTANTS (Detailed Design Stage)

(M/M)

	Speciality	Headworks & Headreach			Sub-area-I			Sub-area-II		
		Home	Field	Total	Home	Field	Total	Home	Field	Total
1.	Project Director	-	1.0	1.0	-	1.0	1.0	-	1.0	1.0
2.	Team Leader	-	12.0	12.0	-	15.0	15.0	-	12.0	12.0
3.	Irrigation Planning Engineer	-	6.0	6.0	-	6.0	6.0	-	6.0	6.0
4.	Irrigation Design Engineer (1)	-	8.0	8.0	-	15.0	15.0	-	12.0	12.0
5.	" (2)	-	8.0	8.0	-	15.0	15.0	-	12.0	12.0
6.	" (3)	-	6.0	6.0	-	15.0	15.0	-	12.0	12.0
7.	Civil Engineer	-	6.0	6.0	-	-	-	-	3.0	3.0
8.	Quantity Surveyor (1)	-	4.0	4.0	-	6.0	6.0	-	5.0	5.0
9.	" (2)	-	-	-	-	4.0	4.0	-	3.0	3.0
10.	Hydraulic Structural Eng. (1)	-	3.0	3.0	-	6.0	6.0	-	6.0	6.0
11.	" (2)	-	-	-	-	4.0	4.0	-	-	-
12.	Hydrologist	-	3.0	3.0	-	-	-	-	3.0	3.0
13.	Geologist	-	4.0	4.0	-	-	-	-	5.0	5.0
14.	Soil Mechanical Engineer	-	3.0	3.0	-	4.0	4.0	-	3.0	3.0
15.	Mechanical Engineer	-	4.0	4.0	-	2.0	2.0	-	2.0	2.0
16.	Construction Planner	-	3.0	3.0	-	3.0	3.0	-	3.0	3.0
17.	Topographic Surveyor (1)	-	4.0	4.0	-	8.0	8.0	-	8.0	8.0
18.	" (2)	-	4.0	4.0	-	8.0	8.0	-	6.0	6.0
19.	" (3)	-	-	-	-	6.0	6.0	-	6.0	6.0
20.	Specialist as required	2.0	5.0	7.0	2.0	7.0	9.0	2.0	6.0	8.0
21.	Home Office Support	4.0	-	4.0	3.0	-	3.0	3.0	-	3.0
	TOTAL			90.0			130.0			120.0

Table X-15 ASSIGNMENT SCHEDULE OF FOREIGN CONSULTANTS (Construction Stage)

Speciality	Man-month (M/M)				
	Headworks and Headreach	Sub-area-I (18,500 ha)	Tertiary Develop. (Sub-area-I)	Sub-area-II (18,200 ha)	Tertiary Develop. (Sub-area-II)
1. Project Director	4	4	-	4	-
2. Team Leader	37	23	-	12	-
3. Construction Engineer (1)	36	40	13	-	-
4. " (2)	30	-	-	40	13
5. Irrigation Engineer	-	18	6	18	6
6. Design Engineer	6	24	-	24	-
7. On-farm Design Engineer (1)	-	6	20	6	20
8. " (2)	-	4	20	4	20
9. Equipment Engineer	6	6	-	6	-
10. Quantity Measurement Engineer	32	24	-	24	-
11. Metal Work Engineer	6	6	-	6	-
12. Soil Mechanical Engineer	8	8	-	8	-
13. Foundation Engineer	6	6	-	6	-
14. Procurement Engineer	3	3	-	3	-
15. Topographic Surveyor (1)	-	10	8	-	8
16. " (2)	-	-	6	10	6
17. Guidance Engineer	12	12	-	12	-
18. Home Office Support & Unallocated	24	16	7	27	7
TOTAL	210	220	80	210	80

Table X-16 PRICE LIST OF LOCAL MATERIALS AND LABOUR WAGES

October, 1980

Item	Unit	Unit Price (Rp)
I. Materials		
1. Gravel (sieved)	m^3	11,000
2. Gravel (not sieved)	m^3	10,000
3. Sand	m^3	3,500
4. Crushed stone	m^3	20,000
5. Masonry stone	m^3	12,000
6. Timber	m^3	150,000
7. Nail	kg	750
II. Fuel and Lubricant		
1. Gasoline	ℓ	175
2. Kerosene	ℓ	75
3. Light diesel oil	ℓ	45
4. Grease	galon	800
III. Labour Wages		
1. Foreman	man-day	1,500
2. Skilled labour	man-day	1,750
3. Common labour	man-day	1,000
4. Mason	man-day	1,750
5. Carpenter	man-day	1,750
6. Blacksmith	man-day	1,750
7. Welder	man-day	1,500
8. Driver	man-day	1,750
9. Operator	man-day	1,750

Table X-17(1) LIST OF UNIT RATE FOR MAJOR WORKS

Work Items	Unit	Foreign Currency	Local Currency	Total
		(US$)	(Rp)	(US$)
I. Earth Works				
1. Land clearing	ha	421.12	128,300	626.40
2. Land leveling	m^3	1.31	375	1.91
3. Land leveling (Finishing)	m^3	0.56	160	0.82
4. Stripping	m^3	0.52	150	0.76
5. Excavation, common (for headworks)	m^3	1.21	493	2.00
6. Excavation, common (for headreach and main canals)	m^3	0.92	372	1.52
7. Excavation, common (for secondary and tertiary canals)	m^3	0.62	344	1.17
8. Excavation for structure	m^3	0.17	400	0.81
9. Excavation, rock (for Ranau regulating dam)	m^3	2.77	1,070	4.48
10. Excavation, rock (for headworks)	m^3	1.85	713	2.99
11. Excavation, rock (for canals)	m^3	1.51	596	2.46
12. Earthfill (borroved material)	m^3	1.66	506	2.47
13. Earthfill (excavated material)	m^3	0.73	195	1.04
14. Backfill for structure	m^3	0.58	567	1.48
15. Sod facing	m^3	-	92	0.15

(to be continued)

Table X-17(2) LIST OF UNIT RATE FOR MAJOR WORKS

Work Items	Unit	Foreign Currency	Local Currency	Total
		(US$)	(Rp)	(US$)
II. Concrete Works				
1. Concrete, Type-A (for reinforcement concrete)	m^3	64.17	7,671	76.44
2. Concrete, Type-B (for plain concrete)	m^3	49.22	6,519	59.65
3. Concrete, Type-C (for lining)	m^3	48.03	6,379	58.24
4. Mortar	m^3	58.06	9,173	72.73
5. Reinforcement bar	ton	1,510.00	36,525	1,568.44
6. Concrete form, Type-A (wooden)	m^2	-	5,264	8.42
7. Concrete form, Type-B (metal)	m^2	1.58	1,301	3.66
8. Concrete form, Type-C (wooden and metal)	m^2	0.47	4,075	6.99
9. West stone masonry (for headworks site)	m^2	10.89	8,423	24.37
10. West stone masonry (for canal)	m^2	6.93	5,418	15.60
11. West stone masonry (for related structure)	m^3	20.79	16,254	46.80
12. Dry stone masonry	m^2	1.02	4,345	7.97

(to be continued)

Table X-17(3) LIST OF UNIT RATE FOR MAJOR WORKS

Work Items	Unit	Foreign Currency	Local Currency	Total
		(US$)	(Rp)	(US$)
III. Pavement Works				
1. Gravel pavement (t=20.0cm)	m^2	3.47	1,119	5.26
2. Laterite pavement (t=20.0cm)	m^2	1.20	402	1.85
IV. Others				
1. Steel works	ton	1,502.08	66,401	1,608.32
2. Sheet pile	m	51.49	3,010	56.31
3. Sheet pile (for temporary works)	m	15.24	2,444	19.15
4. Concrete pile (ϕ400)	m	36.53	2,874	41.13
5. Concrete block	m^3	32.87	19,180	63.56
6. Gabion	m^2	-	10,754	17.21
7. Concrete pipe ϕ900	m	73.10	2,664	77.37
ϕ700	m	51.47	1,863	54.45
ϕ500	m	30.84	1,244	32.83
ϕ400	m	21.03	1,026	22.67
ϕ300	m	11.22	807	12.51
V. Gates				
1. Roller gates				
3,800x2,700	no.	59,500	8,042,000	72,400
3,500x2,700	no.	57,300	7,857,000	69,900

(to be continued)

Table X-17(4) LIST OF UNIT RATE FOR MAJOR WORKS

Work Items	Unit	Foreign Currency	Local Currency	Total
		(US$)	(Rp)	(US$)
2. Slide gates				
2,500x2,000	no.	26,800	3,965,000	33,100
2,000x2,000	no.	22,700	3,561,000	28,400
2,000x1,600	no.	19,700	3,208,000	24,800
1,500x1,600	no.	15,400	2,714,000	19,700
1,500x1,500	no.	14,700	2,643,000	19,000
1,300x1,300	no.	12,100	2,221,000	15,600
1,100x1,100	no.	10,100	1,904,000	13,100
1,000x1,000	no.	8,800	1,693,000	11,500
ϕ900	no.	2,700	488,000	3,500
ϕ700	no.	2,000	357,000	2,500
ϕ500	no.	1,200	226,000	1,600
ϕ400	no.	900	159,000	1,100
ϕ300	no.	500	95,000	700

Table X-18 ANNUAL OPERATION & MAINTENANCE COST

Item	Cost	
	Amount	per Ha
	(10^3Rp)	(Rp/ha)
1. Salaries & Wages		
1.1 Staff salaries (see Table X-20)	133,080	(3,626)
1.2 Labour wages 500 M/M @ Rp.30,000	15,000	(409)
2. Office Expenses L.S	7,200	(196)
3. Operation Cost		
3.1 Gate operation of headworks L.S	11,500	(313)
3.2 Vehicles L.S	23,000	(627)
4. Maintenance Cost		
4.1 Ranau Regulating Dam	6,900	(188)
4.2 Headworks and Headreach	66,300	(1,807)
4.3 Sub-area I (18,500 ha)	187,400	(10,130)
4.4 Sub-area II (18,200 ha)	248,600	(13,659)
5. Miscellaneous	21,020	(573)
TOTAL	720,000	(19,619)
	(US$ 1,152,000	(31.4 US$/ha))

Table X-19 STAFF SALARY AT O & M STAGE

Item	Required Number	Monthly Unit Rate (Rp)	Yearly Amount (10^3Rp)
1. Project Office	2		2,340
(1) Project Manager	1	150,000	1,800
(2) Secretary/Typist	1	4,500	540
2. Administrative Division	10		7,740
(1) Administrative Officer (Chief)	1	100,000	1,200
(2) Accountant	1	80,000	960
(3) Cashier	1	80,000	960
(4) Finance Officer	1	80,000	960
(5) Personnel Officer	1	80,000	960
(6) Clerks/Typists	3	45,000	1,620
(7) Store keeper	2	45,000	1,080
3. Technical Division	32		22,800
(1) Civil Engineer (Chief)	1	100,000	1,200
(2) Irrigation Engineer	1	80,000	960
(3) Design Engineer	1	80,000	960
(4) Construction Engineer	2	80,000	1,920
(5) Field Supervisor	3	60,000	2,160
(6) Mechanical Engineer	1	80,000	960
(7) Mechanic	1	60,000	720
(8) Electrician	1	60,000	720
(9) Operator	5	60,000	3,600
(10) Driver	8	45,000	4,320
(11) Water Officer	1	80,000	960
(12) Assist. Water Officer	3	60,000	2,160
(13) Clerks/Typists	4	45,000	2,160
4. Sub-Office	160		100,200
(1) Sub-office Chief	5	100,000	6,000
(2) Officer	25	80,000	24,000
(3) Waterman	130	45,000	70,200
TOTAL	204		133,080

Table X-20 REPLACEMENT COST AND USEFUL LIFE

Item	Useful Life (years)	Replacement Cost (US$)
1. O & M Equipment	10	4,888,000
2. Project Facilities		
2.1 Ranau regulating dam, gate	25	202,000
2.2 Headworks		
- Gate	25	3,079,000
- Electric facilities	20	441,000
2.3 Irrigation facilities, gate	25	6,736,000

ANNEX XI

PROJECT EVALUATIONS

ANNEX - XI

PROJECT EVALUATIONS

1. GENERAL

The project evaluation is carried out in order to ascertain the feasibility of the project in view of economic, financial and socio-economic aspects.

The economic feasibility for the project is firstly evaluated by calculating the economic internal rate of return (hereinafter referred to as the "IRR"). Further, sensitivity analysis of IRR is also made with respect to change in the economic project cost, market price of paddy and unit yield of paddy. In the calculation, the economic costs and benefits are estimated based on the study results in ANNEX-V and X.

Secondly, the financial aspect is evaluated by calculating the capacity to pay and by preparing the repayment schedule of project capital cost. The calculation of capacity to pay is to confirm the soundness of the project from the farmers' viewpoint. The repayment schedule is made to estimate the annual subsidy by the Government based on the estimated fund requirements with the assumed financial terms of the conceivable loan and the expected revenue from the project.

Finally, intangible socio-economic impacts of the project are briefly studied in due consideration of the effect of the project on the regional development.

2. ECONOMIC EVALUATION

2.1 Basic Assumptions

For the economic evaluation of the project, the following basic assumptions are established.

i) The project implementation period is nine years from 1983 to 1991 as mentioned in ANNEX-VIII.

ii) Only direct benefit is counted in the evaluation and any indirect or intangible benefits are not taken into account.

iii) The current prices as of the end of 1980 are used in the evaluation.

iv) The exchange rate of Indonesian Rupiah to US Dollar is taken to be Rp.625 equivalent to US$1.

v) The economic useful life of the project is taken as 50 years from 1983 to 2032.

2.2 Economic Price

As stated in ANNEX-VI, economic farm gate prices of crop production and farm inputs are estimated based on the projected international market price forcasted by IBRD in the long term range for 1990 based on 1977 constant US Dollars.

The economic prices of the construction materials and equipment to be imported from abroad are estimated based on the CIF prices in Palembang which are preliminary converted from the present FOB prices in Japan, and cost and price related to the inland transportation between Palembang and Belitang.

As for the local materials, labour wages, etc. related to the construction and farming practices, the present market price is directly taken into account.

2.3 Project Cost

2.3.1 Economic Cost

The project cost broadly comprises the costs for:

i) preparatory works,
ii) construction of project facilities,
iii) land acquisition,
iv) procurement of O & M equipment (first procurement only)
v) administration expenses,
vi) engineering services,
vii) physical contingency, and
viii) price contingency.

Among the costs mentioned above, all the costs except the costs for land acquisition and price contingency are counted as the economic cost. In addition, the following costs are also counted as the economic cost.

i) The construction cost for the on-farm development works which will be constructed by farmers themselves. This cost is estimated to be Rp.1,888x10^6 using the opportunity cost for labor, 300Rp./day/laborer.

ii) The cost for jungle clearing which will be done by the transmigrants who will settle before the start of project construction works. The cost is estimated to be Rp.1,800x10^6 applying the opportunity cost for labor of 300 Rp./day/laborer.

The total economic cost and its annual disbursement thus estimated are as shown in Table XI-1 and XI-2.

2.3.2 Annual Operation and Maintenance Costs

In addition to the O & M costs estimated in ANNEX-X, the O & M of Rp.26x10^6 to be required in the elevated lands (1,300ha) in the Belitang proper area, which will be benefited by the Komering-I project facilities, are also taken into account in the evaluation. The annual

increase of the O & M costs during the build-up period of the project is shown in Table XI-4.

2.3.3 Replacement Costs

The replacement costs estimated in ANNEX-X will be required at the interval of the economic useful life of each facility.

2.4 Project Benefit

The direct project benefit is evaluated as the difference of net income from crops in future between without project and with project.

The benefit will come out immediately after the implementation of land reclamation, even before the completion of the total construction works. The benefit is expected to take linear increase and attain its maximum level of Rp. $33,391 \times 10^6$ (US53.4×10^6) at full development stage, which includes the benefit derived from the elevated lands of 1,300ha in the Belitang proper area.

The anticipated annual incremental benefit of the project are estimated in terms of economic value as shown in Table XI-3.

2.5 Internal Rate of Return (IRR)

Using the costs and benefit estimated in the above, the cost and benefit streams are firstly prepared as shown in Table XI-4, then the IRR is calculated by electronic computer. The calculated IRR is around 16.2% and indicates the economic soundness of the project.

2.6 Sensitivity Analysis

In order to evaluate further the soundness of the project to the possible changes of economic conditions in future, the sensitivity analysis is made for the following critical conditions in terms of internal rate of return.

i) cost increase due to unforeseen geological and topographical conditions and increase of material costs.

ii) Decrease of forecasted market price of paddy

iii) Lower production than the expected.

For the above possible changes of economic conditions, the following eight cases are examined.

	I	II	III	IV	V	VI	VII	VIII
Cost	0	0	+10%	+10%	+10%	+20%	+20%	+20%
Benefit	-10%	-20%	0	-10%	-20%	0	-10%	-20%

The calculated result of IRR for each case is shown in Table XI-5. From these results, it can be said that the project would be still sound even in the worst case, i.e. 20% increase of cost and 20% decrease of benefit.

3. FINANCIAL EVALUATION

3.1 General

The financial feasibility of the project is evaluated from the viewpoint of farmer's economy. In this connection, the assessment on the amount of water charge to be collected from the water users is made on preliminary basis. The study on the capability of capital cost repayment is also made on the project level by preparing the cash flow table.

3.2 Financial Cost

Based on the current market prices and costs as of the end of 1980, the financial cost of the project is estimated to be US$321,249x10^3 equivalent comprising Rp. 76,179x10^6 (US$121,887x10^3 equivalent) for the local currency and US$199,362x10^3 for the foreign currency as shown in ANNEX-X (Table X-1). In this estimate, the physical contingency of 10%, and the price contingency of 8% per annum for the local currency and 5% per annum for the foreign currency are considered to the direct cost. Table X-3 in ANNEX-X shows the annual disbursement schedule of the said financial cost.

3.3 Capacity to Pay

For evaluating the project feasibility from the financial aspect of farmers, typical farm budget analyses are made under both the future with project and the future without project conditions as shown in ANNEX VI.

The capacity to pay expected under the future with project condition would be Rp.214,500 (US$343.2) in 1.0ha area, Rp.362,700 (US$580.3) in 1.5ha area and Rp.231,800 (US$370.9) in the Pisang area per annum respectively.

3.4 Water Charge

When the project facilities are completed and water is released to the farmers, but if the water charge is not be collected, all the costs of the project will have to be born by the Government, and such expenditure will become a heavy burden to the Government. It is generally understood that the water charge is imposed to the water users, and the water charges thus collected is spent for the payment of O & M expenditures incurred to the project and for the repayment of the capital cost of the project. In Indonesia, however, the farmers traditionally do not pay any water charge directly, but contribute indirectly by paying the IPEDA tax.

The recent Government's decree and agreements made with the international lending institutions provide the conditions that the Government shall collect the water charges from the water users and recover the entire O & M cost, and that the rate of water charge shall be reviewed and possibly increased to recover a portion of the capital cost of the project.

As seen in Table XI-6, the annual O & M cost required for the project is estimated at US$1,152x10^3 which is equivalent to about US$31.4/ha. This corresponds to about 9.1% of the capacity to pay in 1.0ha area, 8.1% in 1.5ha area and 12.7% in the Pisang area. On the other hand, the annual scale of amount for the repayment of the capital cost is estimated at about US$9,927x10^3 for the foreign currency portion and US$5,982x10^3 equivalent for the local currency portion, which are equivalent US$270/ha and US$163/ha respectively. These repayments would not be covered obviously with the capacity to pay from the viewpoint of the farmer's economy.

The water charge to be collected from the water users would have to be within a reasonable range in the capacity to pay that could still give sufficient incentive to the farmers. With this view, the prospective water charge is recommended to be Rp.19,700/ha/annum, i.e. the required O & M cost. This prospective water charge would be the project revenue in the financial evaluation on the project.

3.5 Repayment of Project Cost

The financial evaluation of the project is made by examining the repayment capability for the capital cost of the project. For the examination, the cash flow table using the anticipated project revenue and fund requirement.

In the examination of repayment capability, it is assumed that the capital required for the project implementation will be arranged under the following conditions:

i) For the foreign currency portion, the capital is financed by bilateral or international organizations with an interest of 2.5% per annum for a repayment period of 30 years including 10-year grace period.

ii) For the local currency portion, the capital is financed by the budget allocation of the Government with no repayment.

Based on the above conditions, the repayment schedule for the foreign currency portion is prepared as shown in Table XI-6. This table indicates that the direct revenue from the water charge can not cover the annual repayment of the fund, except for the O & M cost, and the repayment of the fund has to be made by the subsidy of the Government.

4. SOCIO-ECONOMIC IMPACT

In addition to the direct benefits stipulated in the economic evaluation, favourable but intangible socio-economic impacts are expected from the implementation of the project.

4.1 Foreign Exchange Saving

Under the project implementation, paddy production will increase to about 269,500 tons per annum from the present production of 51,700 tons. Out of this increased production, it is expected that the marketable rice would be about 160×10^3 tons after deducting the local consumption. This surplus would reduce the annual amount of imported rice, resulting in the saving of foreign exchange amounting to around US$60 million equivalent.

4.2 Increase of Employment Opportunity to Local People

Employment opportunity to the local people will be increased by the project implementation, and a favourable impact will be given to the national economy. Furthermore, the employee will be able to gain more experience, technical know-how, skillfulness in the various working fields. These accumulations would be applied to the future development in South Sumatra Province.

4.3 Improvement of Local Transportation

The local transportation will be improved much by the construction of the operation and maintenance roads along the irrigation canals. The expanded road system will not only enhance the economic activity in and around the project area but also contribute to inter-regional accessibility and communications.

4.4 Improvement of Environmental Sanitation

The construction of the project works would have a possitive effect on the overall ecology of the project area. The health and sanitary conditions would become better with drainge improvement as well as supply of fresh water through the irrigation canals.

Table XI-1 SUMMARY OF ECONOMIC COST

Unit: US$10^3

Item	Economic Cost
1. Headworks and Headreach	24,640
2. Sub-area-I (18,500 ha)	48,701
3. Tertiary Development, Sub-area-I	11,274
4. Sub-area-II (18,200 ha)	69,247
5. Tertiary Development, Sub-area-II	12,500
6. Jungle Clearing	1,800
7. On-farm Development	1,888
Sub-total (item 1 to 6)	170,050
8. O & M Equipment	4,888
9. Administration Expenses	2,534
10. Engineering Services	16,072
11. Physical Contingency	17,005
TOTAL (item 1 to 11)	210,549

Table XI-2 ANNUAL DISBURSEMENT SCHEDULE OF ECONOMIC COST

Unit: US$10^3

Item	Total	1983	1984	1985	1986	1987	1988	1989	1990	1991
1. Headworks and Headreach/1	24,640	363	3,663	5,028	4,673	4,190	6,723	-	-	-
2. Sub-area-I (18,500 ha)	48,701	-	-	1,429	8,053	12,687	12,503	7,594	6,435	-
3. Tertiary Development, Sub-area-I	11,274	-	-	-	-	-	3,382	4,510	3,382	-
4. Sub-area-II (18,200 ha)	69,247	-	-	-	2,078	11,200	17,759	18,142	10,227	9,841
5. Tertiary Development, Sub-area-II	12,500	-	-	-	-	-	-	3,751	5,001	3,748
6. Jungle Clearing	1,800	-	-	-	153	489	360	360	309	129
7. On-farm Development	1,888	-	-	-	-	-	165	625	779	319
Sub-total (item 1 to 6)	170,050	363	3,663	6,457	14,957	28,566	40,892	34,982	26,133	14,037
8. O & M Equipment	4,888	1,174	2,738	293	292	196	195	-	-	-
9. Administration Expenses	2,534	101	154	274	298	328	347	353	345	334
10. Engineering Services	16,072	998	1,671	1,959	2,713	1,990	2,366	2,016	1,717	642
11. Physical Contingency	17,005	36	366	646	1,496	2,857	4,089	3,498	2,613	1,404
TOTAL (item 1 to 11)	210,549	2,672	8,592	9,629	19,756	33,937	47,889	40,849	30,808	16,417

/1: Including the cost for office and quarters.

Table XI-3 ANNUAL INCREMENTAL BENEFIT

Year	Belitang Extension Area 1.0ha area 8400ha (Rp.10^6)	Belitang Extension Area 1.5ha area 25400ha (Rp.10^6)	Pisang Area 1.5ha area 2900ha (Rp.10^6)	Existing Properarea 1300ha (Rp.10^6)	Total Increment 38000ha (Rp.10^6)	Total Increment 38000ha (US10^3)
1986	- 5	-20	-	-	-25	-40
1987	-10	58	- 2	-	46	74
1988	25	856	72	-	953	1,524
1989	3,494	6,156	275	513	10,438	16,702
1990	4,786	10,342	1,023	661	16,812	26,898
1991	5,837	13,734	1,578	746	21,895	35,030
1992	6,316	15,917	1,980	746	24,959	39,933
1993	6,377	16,975	2,129	746	26,227	41,961
1994	6,402	17,409	2,262	746	26,819	42,909
1995	6,408	17,583	2,311	746	27,048	43,275
1996	6,408	17,661	2,330	746	27,145	43,431

Note: The minus benefit will take place before start of irrigation with project, because no agricultural benefit is expected in the upland fields during the reclamation of these area under the "with project" condition, whereas some crops can be planted in the corresponding area under the "without project" condition.

Table XI-4 COST-BENEFIT STREAM

Unit : US$10^3

Year	Year in Order	Economic Cost				Incremental Benefit
		Capital Cost	Replacement Cost	O&M Cost	Total	
1983	1	2627.	0.	0.	2627.	0.
1984	2	8592.	0.	0.	8592.	0.
1985	3	9629.	0.	0.	9629.	0.
1986	4	19756.	0.	0.	19756.	-40.
1987	5	33937.	0.	0.	33937.	74.
1988	6	47889.	0.	0.	47889.	1524.
1989	7	40849.	0.	799.	41648.	16702.
1990	8	30808.	0.	974.	31782.	26898.
1991	9	16417.	0.	1125.	17542.	35030.
1992	10	0.	0.	1193.	1193.	39933.
1993	11	0.	0.	1193.	1193.	41961.
1994	12	0.	0.	1193.	1193.	42909.
1995	13	0.	0.	1193.	1193.	43275.
1996	14	0.	0.	1193.	1193.	43431.
1997	15	0.	0.	1193.	1193.	43431.
1998	16	0.	4888.	1193.	6081.	43431.
1999	17	0.	0.	1193.	1193.	43431.
2000	18	0.	0.	1193.	1193.	43431.
2001	19	0.	0.	1193.	1193.	43431.
2002	20	0.	0.	1193.	1193.	43431.
2003	21	0.	0.	1193.	1193.	43431.
2004	22	0.	0.	1193.	1193.	43431.
2005	23	0.	0.	1193.	1193.	43431.
2006	24	0.	0.	1193.	1193.	43431.
2007	25	0.	0.	1193.	1193.	43431.
2008	26	0.	5329.	1193.	6522.	43431.
2009	27	0.	0.	1193.	1193.	43431.
2010	28	0.	0.	1193.	1193.	43431.
2011	29	0.	0.	1193.	1193.	43431.
2012	30	0.	0.	1193.	1193.	43431.
2013	31	0.	10017.	1193.	11210.	43431.
2014	32	0.	0.	1193.	1193.	43431.
2015	33	0.	0.	1193.	1193.	43431.
2016	34	0.	0.	1193.	1193.	43431.
2017	35	0.	0.	1193.	1193.	43431.
2018	36	0.	4888.	1193.	6081.	43431.
2019	37	0.	0.	1193.	1193.	43431.
2020	38	0.	0.	1193.	1193.	43431.
2021	39	0.	0.	1193.	1193.	43431.
2022	40	0.	0.	1193.	1193.	43431.
2023	41	0.	0.	1193.	1193.	43431.
2024	42	0.	0.	1193.	1193.	43431.
2025	43	0.	0.	1193.	1193.	43431.
2026	44	0.	0.	1193.	1193.	43431.
2027	45	0.	0.	1193.	1193.	43431.
2028	46	0.	5329.	1193.	6522.	43431.
2029	47	0.	0.	1193.	1193.	43431.
2030	48	0.	0.	1193.	1193.	43431.
2031	49	0.	0.	1193.	1193.	43431.
2032	50	0.	0.	1193.	1193.	43431.

IRR = 16.2%

Table XI-5 SENSITIVITY ANALYSIS

Cost Increased	Internal Rate of Return (%) Benefit Decreased		
	0	-10%	-20%
0	16.2	14.7	13.2
+10%	14.9	13.5	12.1
+20%	13.8	12.5	11.2

Table XI-6 FINANCIAL CASH FLOW STATEMENT

Unit: US$10^3

Year	Loan Disbursement	Accumulated Loan	Cash Outflow				Cash Inflow			Balance of Payment (B) - (A)
			O & M Cost	Repayment of Loan Interest	Repayment of Loan Capital/1	Total Outflow(A)	Project Revenue	Government Subsidy	Total Inflow(B)	
1983	2,229	2,229	-	55.7	-	55.7	-	55.7	55.7	0
1984	7,212	9,441	-	236.0	-	236.0	-	236.0	236.0	0
1985	9,292	18,733	-	468.3	-	468.3	-	468.3	468.3	0
1986	17,743	36,476	-	911.9	-	911.9	-	911.9	911.9	0
1987	30,695	67,171	-	1,679.3	-	1,679.3	-	1,679.3	1,679.3	0
1988	46,360	113,531	-	2,838.3	-	2,838.3	-	2,838.3	2,838.3	0
1989	38,715	152,246	798	3,806.2	-	4,564.2	758	3,806.2	4,564.2	0
1990	30,217	182,463	933	4,561.6	-	5,494.6	933	4,561.6	5,494.6	0
1991	16,899	199,362	1,084	4,984.1	-	6,068.1	1,084	4,984.1	6,068.1	0
1992		199,362	1,152	4,984.1	1,795.4	7,931.5	1,152	6,779.5	7,931.5	0
1993		197,566.6	1,152	4,939.2	4,566.9	10,658.1	1,152	9,506.1	10,658.1	0
1994		192,999.7	1,152	4,825.0	8,530.4	14,507.4	1,152	13,355.4	14,507.4	0
1995		184,469.3	1,152	4,611.7	8,530.4	14,294.1	1,152	13,142.1	14,294.1	0
1996		175,938.9	1,152	4,398.5	8,530.4	14,080.9	1,152	12,928.9	14,080.9	0
1997		167,408.5	1,152	4,185.2	9,195.6	14,532.8	1,152	13,380.8	14,532.8	0
1998		158,212.9	1,152	3,955.3	9,968.1	15,075.4	1,152	13,923.4	15,075.4	0
1999		148,244.8	1,152	3,706.1	9,968.1	14,826.2	1,152	13,674.2	14,826.2	0
2000		138,276.7	1,152	3,456.9	9,968.1	14,577.0	1,152	13,425.0	14,577.0	0
2001		128,308.6	1,152	3,207.7	9,968.1	14,327.8	1,152	13,175.8	14,327.8	0
2002		118,340.5	1,152	2,958.5	9,968.1	14,078.6	1,152	12,926.6	14,078.6	0
2003		108,372.4	1,152	2,709.3	9,968.1	13,829.4	1,152	12,677.4	13,829.4	0
2004		98,404.3	1,152	2,460.1	9,968.1	13,580.2	1,152	12,428.2	13,580.2	0
2005		88,436.2	1,152	2,210.9	9,968.1	13,331.0	1,152	12,179.0	13,331.0	0
2006		78,468.1	1,152	1,961.7	9,968.1	13,081.8	1,152	11,929.8	13,081.8	0
2007		68,500.0	1,152	1,712.5	9,968.1	12,832.6	1,152	11,680.6	12,832.6	0
2008		58,531.9	1,152	1,463.3	9,968.1	12,583.4	1,152	11,431.4	12,583.4	0
2009		48,563.8	1,152	1,214.9	9,968.1	12,335.0	1,152	11,183.0	12,335.0	0
2010		38,595.7	1,152	964.9	9,968.1	12,085.0	1,152	10,933.0	12,085.0	0
2011		28,627.6	1,152	715.7	9,968.1	11,835.8	1,152	10,683.8	11,835.8	0
2012		18,659.5	1,152	466.5	8,172.7	9,791.2	1,152	8,639.2	9,791.2	0
2013		10,486.8	1,152	262.2	5,401.3	6,815.5	1,152	5,663.5	6,815.5	0
2014		5,085.5	1,152	127.1	1,437.8	2,716.9	1,152	1,564.9	2,716.9	0
2015		3,647.7	1,152	91.2	1,437.8	2,681.0	1,152	1,529.0	2,681.0	0
2016		2,209.9	1,152	55.2	1,437.8	2,645.0	1,152	1,493.0	2,645.0	0
2017		772.5	1,152	19.3	772.5	1,943.8	1,152	791.8	1,943.8	0
2018		0	1,152	0	0	1,152.0	1,152	0	1,152.0	0

/1 : The figures in this column are the accumulation of the repayment for five loans having the different repayment periods.

ANNEX XII

PILOT DEMONSTRATION SCHEME

ANNEX - XII

PILOT DEMONSTRATION SCHEME

1. GENERAL

The present farming practices in the project area are still primitive and the farmers are not familiar to irrigation farming of which knowledge would become essential for the proposed agricultural development. Other constraints observed in the project area are shortage of qualified field extension workers and insufficient facilities for seed multiplication and its distribution system. In order to attain the projected target of the agricultural development in the area, improvement of the present agricultural situation is in urgent need. In this context, it is recommended to establish a pilot demonstration scheme in advance to the completion of the Komering-I Irrigation Development Project, so that the experiences cumulated through the operation of the pilot demonstration scheme would be applied to the project operation from its start.

2. OBJECTIVES OF THE SCHEME

The scheme will be established with the following purposes:

(1) Tertiary development through construction of the irrigation and drainage facilities as well as road network, as the model of future development,

(2) Organization of the model for water management body in the scheme area,

(3) Demonstration of modernized Irrigation farming to the farmers on the irrigated condition, and

(4) Field experiments on irrigation engineering matters.

3. SELECTION OF SCHEME AREA

The selection of the scheme area is made taking into account the following matters:

(1) The scheme area should be selected in one or two administrative units (village units) for the simplification of farmers' organization to be established in the scheme area.

(2) Irrigation water should be available and easily be taken with temporary facilities.

(3) So as to control the drainage water without constructing a large scale system, the area should be located in the individual small drainage basin.

(4) The soils in the selected area should represent the soils over the Komering-I Project area.

(5) Accessibility to the area should be good for smooth transportation and communication.

(6) Since the irrigation and drainage networks to be constructed in the scheme area will be integrated in the Komering-I system, the site should be selected taking into account the future canal layout of the Komering-I system.

As the result, the Kurungan Nyawa area is recommended for the scheme as shown in Fig. XII-1. The area covers about 900 ha of land in gross, of which around 700 ha is selected as a net scheme area.

4. THE SCHEME AREA

The selected area extends over two villages; 400 ha in Kurungan Nyawa and 300 ha in Tebat Jaya. All the part of area is being cultivated with paddy. The northern boundary of the area is formed by the asphalt-paved road constructed along the Belitang Irrigation Canal (proper). The paved state road linking Martapura to Palembang also runs across the northwest corner of the scheme area. Other than these two trunk roads, village road network, all of which are unmetalled, are well developed in the scheme area.

The soils in the area are derived from heavy textured alluvium deposited in the quaternary land formation stage. The soils are typical Low Humic Gley Soils and Hydromorphic Alluvial Soils being predominant over the paddy field area in the Komering-I area. In the area, there exist small drainage channels constructed by farmers and small stream, which can be used as drainage canals for the scheme after modification. Irrigation water will be taken by a pump from the Komering river running near the scheme area.

The average land holding per farm household including tenant and cultivation right is estimated to be about 1.0 ha. Since no irrigation facility exists at present, most of the area is being cultivated with rain-fed paddy. The yield of paddy in the area is about 2.6 tons/ha on an average.

5. FACILITIES REQUIRED FOR THE SCHEME

In order to achieve the objectives of the scheme mentioned in the Section 2 hereof, the following facilities are required and the direct construction cost for the facilities is estimated as shown in Table XII-1.

(1) Pump Station

- Pump equipment

Pump type	:	Horizontal shaft double suction volute type
Pump capacity	:	30 m^3/min
Rated head	:	10 m
No. of pump	:	2 sets
Generating system	:	Diesel generator, 110 ps x 2 nos.
- Discharge pipeline	:	70 m
No. of pipeline	:	1 no.
Pipe material	:	Steel
Internal diameter	:	800 mm
- Pump house	:	100 m^2

(2)	Irrigation canal	:	20 km
	- Design capacity	:	1 m^3/sec
	- Type of canal	:	Trapezoidal earth canal
(3)	Drainage canal	:	22 km
	- Unit drainage requirement	:	7.5 lit/sec/ha
	- Type of canal	:	Trapezoidal earth canal
(4)	Inspection road	:	24 km
(5)	Office	:	300 m^2

Table XII-1 (1) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR PILOT DEMONSTRATION SCHEME

Works	Unit	Q'ty	Foreign Currency (US$)	Local Currency (10^3Rp)
1. Preparatory Works		L.S.	184,500	55,600
2. Pump Station			341,000	33,600
2.1 Inlet channel		L.S.	3,360	2,360
2.2 Pump house	m^2	100	-	12,000
2.3 Discharge pipeline			58,000	4,080
2.3.1 Civil works		L.S.	1,500	550
2.3.2 Metal works	t	20	56,500	3,530
2.4 Outlet structure		L.S.	1,640	460
2.5 Pump equipment	sets	2	278,000	14,700
3. Irrigation Canals and Inspection Roads			252,910	67,630
3.1 Secondary canal and secondary inspection road			133,370	43,440
Secondary canal			(48,820)	(16,520)
3.1.1 Site clearing and stripping	ha	4	2,080	600
3.1.2 Excavation	m^3	12,000	7,440	4,130
3.1.3 Earthfill	m^3	26,200	39,300	11,790
Secondary inspection road			(84,550)	(26,920)
3.1.4 Site clearing and stripping	ha	6	3,120	900
3.1.5 Earthfill	m^3	25,200	41,830	12,750
3.1.6 Laterite pavement	m^2	33,000	39,600	13,270

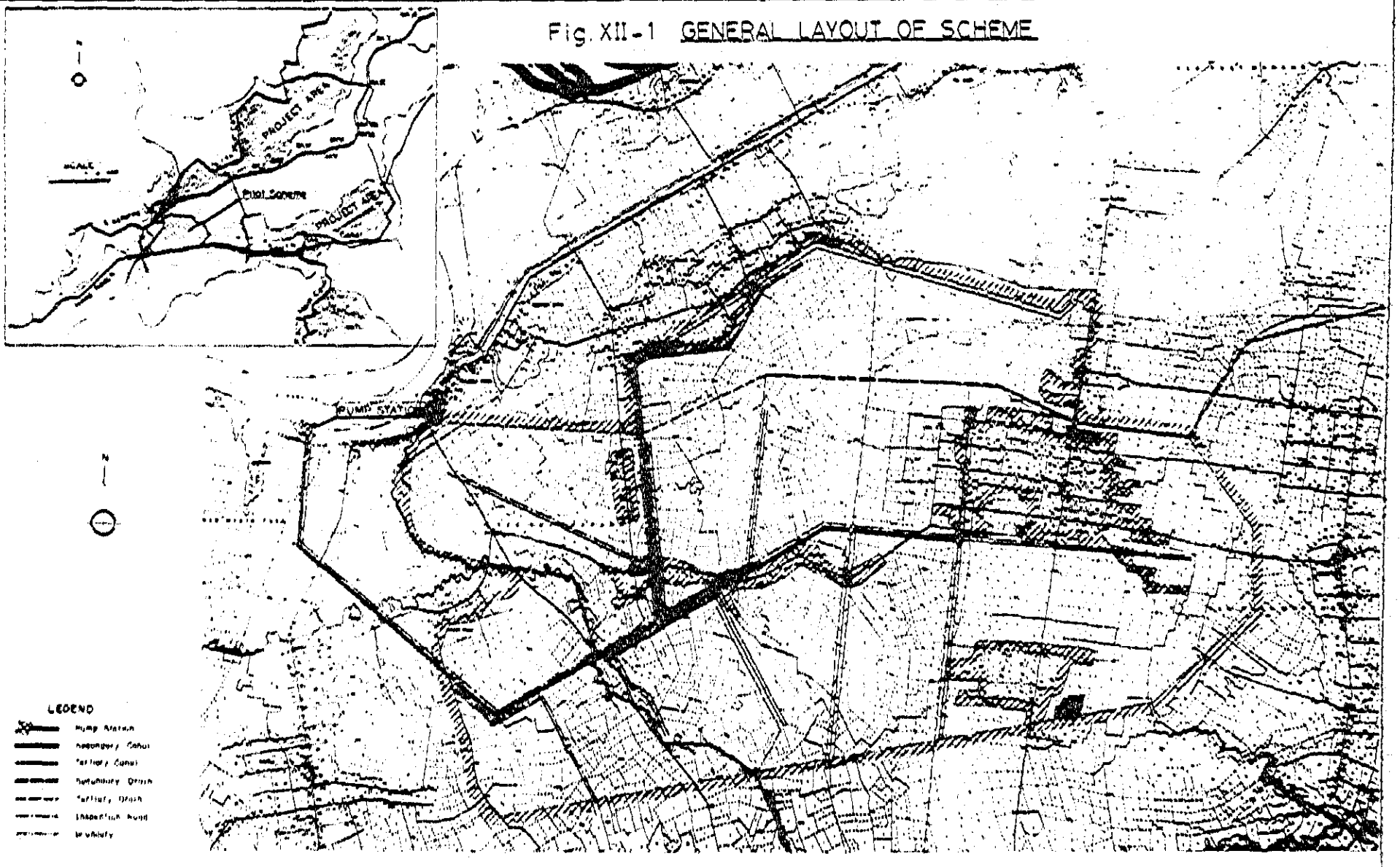
(to be continued)

Table XII-1 (2) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR PILOT DEMONSTRATION SCHEME

Works	Unit	Q'ty	Foreign Currency (US$)	Local Currency (10^3 Rp)
3.2 Related structure			119,540	24,190
3.2.1 Syphon	no.	1	2,980	720
3.2.2 Turnout	nos.	4	13,600	3,440
3.2.3 Check gate	nos.	2	21,000	3,780
3.2.4 Culvert	nos.	6	14,400	3,600
3.2.5 Spillway	no.	1	48,800	9,800
4. Drainage Canals			102,540	50,410
4.1 Secondary drain			60,490	31,900
4.1.1 Site clearing and stripping	ha	12	6,240	1,800
4.1.2 Excavation	m^3	87,500	54,250	30,100
4.2 Tertiary drain			26,550	13,210
4.2.1 Site clearing and stripping	ha	11	5,720	1,650
4.2.2 Excavation	m^3	33,600	20,830	11,560
4.3 Related structure		L.S.	15,500	5,300
5. Tertiary Development			245,940	90,310
5.1 Tertiary canal and tertiary inspection road			138,260	43,180
Tertiary canal			(74,800)	(23,920)
5.1.1 Site clearing and stripping	ha	11	5,720	1,650
5.1.2 Excavation	m^3	9,800	6,080	3,370
5.1.3 Earthfill	m^3	42,000	63,000	18,900
Tertiary inspection road			(63,460)	(19,260)
5.1.4 Site clearing and stripping	ha	8	4,160	1,200
5.1.5 Earthfill	m^3	35,700	59,300	18,060
5.2 Tertiary division box	nos.	55	18,760	2,850
5.3 Quaternary system		L.S.	88,920	44,280
6. Pilot Scheme Office		L.S.	-	37,000
7. Miscellaneous		L.S.	112,110	33,450
TOTAL			1,239,000	368,000

(US$ 1,827,800)

Fig. XII-1 GENERAL LAYOUT OF SCHEME



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