iv) The runoff discharge distribution of the consecutive rainfall on daily basis is determined as follows:

Rainfall	1st day	2nd day	3rd day	4th day	Total
mm	%	%	%	%	
below 30	100	-	-	-	100
30 - 50	70	30	-	-	100
50 - 100	60	30	10	-	100
over 100	50	30	15	5	100

v) The runoff coefficients during the rain is determined as follows:

Rainfall (mm)	10	10-30	30-50	50-100	100-200	200-300	300
Runoff (%)	0	10	30	50	80	90	95

vi) In Southeast Asian countries, it rarely rains evenly covering an entire river basin of a large scale. Instead, so called " spot rainfall" prevails under the situations, the following reduction rates are employed in determining the runoff coefficient in varying scales of drainage areas.

Runoff Reduction Ratio

Drainage Area (sq.km)	Ratio
0 - 3	1.00
3 - 8	0.90
8 - 16	0.85
16 - 30	0.80
30 - 80	0.75
80 - 160	0.70
over 160	0.65

4.5.2. Unit Drainage Discharge

By employing the above-mentioned conditions the unit drainage discharges of paddy fields and upland fields are computed as shown in Table A.4.5-2.

4.5.3. Drainage Sluice of Roeng Rang River

A. Flood Drainage Condition in the Project Area

The areas along the Roeng Rang river and Nong Luang river which a tributary of the Pasak river is the lowest in the western part of the Project Area at only 8.50 m (MSL). These areas suffered inundation damages from flood as caused by back water of Pasak river. The inundation area and volume obtained from topo-map (scaled in 1:10,000) are shown in Fig. A.4.5-1.

The highest water levels at the confluence of the Roeng Rang river and Pasak river are calculated from the hydrological data at S2 gauging station and Rama VI Barrage in recent ten years records, as shown in Table A.4.5-3.

As can be seen in Table A.4.5-3, the flood damages are occurred with 1/3 year probability.

B. Relationship between Runoff and Outside Water Level in the Project Area.

The design rainfall is employed the four days consecutive rainfall as mentioned in the previous paragraph 4.5.1 "Unit Drainage Discharge". On the other hand, the flood water level at the Pasak river as an outside water level are also shown in the previous paragraph.

The study on the relationship between the runoff and water level

has been made by using in recent ten years records. The results are shown in Fig.A.4.5-2. As can be seen in the Fig.A.4.5-2, it is rare that the occurrence time of consecutive rainfall overlap with the flood water level at the Pasak river. It seems that has a certain time lag lasting for 7 days to fifteen days.

The Pasak river has a drainage area of 14,522 km^2 at the S2 gauging station and it shows a narrow and long shape which extends from north to south. The rainfall distributions both in drainage area of Pasak basin and Project Area are not uninform. Such big time lag is due to the above said conditions.

And the hydrograph of Pasak river during the flood period has lasted more than two weeks (Refer to Fig.A.4.5-2).

C. Inundation Control Plan

On the basis of the above-mentioned conditions, it is proposed that a drainage sluice will be installed at the conjunction point where Roeng Rang river joins with the Pasak river for the purpose of protecting the lows lying area from serious inundation damage caused by back water from the Pasak river.

The required section of drainage sluice is determined based on the conditions as mentioned in the previous paragraph. The proposed drainage sluice should have enough cross-section to drain the peak discharge under the condition of four-day consecutive rainfalls with the return period of 5-year when the medium flood may occurred in the Pasak river.

(i) The peak runoff discharge is already described in the previous paragraph 4.5.1. As a result, the peak runoff discharge of 55.37 m^3/sec is computed by applying the four-day consecutive rainfall with the return period of

5-year which is equivalent to the rainfalls of 181.2 mm. (See table A.4.5-4)

(ii) The outside water level on the Pasak river is computed by applying the averaged highest water level exclusive of peculiar flood water stage observed at the S2 gauging station and Rama VI Barrage.

The design peak water level at the conjunction point of Roeng Rang river and Pasak river is determined by using proportional allotment by hydraulic gradient of above said two stations. As a result, the designed peak water level of 8.30 m (MSL) for determination of drainage sluice section is obtained. (Refer to Table A.4.5-5)

(iii) From the viewpoint of economy, the designed minimum paddy field elevation of 9.00 m (MSL) is adopted.

(iv) The determination of cross-section of drainage sluice is based on the following formula.

$$Q = A\ V$$

$$V = \frac{2gH}{1 + f_1 + \Sigma f_n + f\frac{L}{4R}}$$

where, Q = Drainage discharge, 55.37 m^3/sec.

A = Flow area (m^2)

v = Velocity (m/sec)

H = Head = 9.00 - 8.30 = 0.70 m

L = Length of Culvert = 24.00 m

R = Hydraulic radius

f_1 = Coefficient of inlet loss = 0.5

f_n = Coefficient of another loss (neglect)

f = Coefficient of friction loss

$f = \frac{2g}{C^2}$ $\quad C = \frac{1}{n} R^{1/6}$ (Chezy & Manning Formula)

n = Roughness: 0.016

2.50 m x 2.50 m x 3 rows

D. Study on Inundation Conditions

The following table shows the probable water levels analyzed based on the data of water levels recorded at S2 gauging station and Rama VI Barrage from 1951 to 1980.

Return Period	Probable Water Level (m) S2 Gauging Station	Rama VI Barrage	Confluence of Roeng Rang River
5	14.94	8.88	9.30
10	16.51	10.12	10.56
20	18.04	10.50	11.02
50	20.06	11.00	11.62
100	21.61	11.71	12.39

Note: Water level at confluence of Roeng Rang river is calculated by proportional allotments between water level of S2 gauging station and Rama VI barrage.

For the purpose of drainage planning in this project, the 5-year return period of probable water level is adopted, taking project economy into consideration.

In the water balance study, the outside water level is determined based on the observed hydrograph at Rama VI barrage in 1980, which will be rectified to cope with 9.30 m (MSL) of 5-year return period. And the four-day consecutive rainfalls with the return period of 5-year are also adopted for this water balance study.

In accordance with aforementioned assumptions, the water balance study in the project area was made under the condition of with/without drainage sluice. The results are as shown in the Figure A.4.5-3. As can be seen in this Figure A.4.5-3, the inundation

period will be shortened by 40 hours as compared between with drainage sluice and without one. On the other hand, the inundation depth will be increased by 0.25 m and about 520 ha of paddy fields will be inundated. The condition is due to the cross-section of Roeng Rang river where become narrow after installation of drainage sluice. It seems that inundation condtions still remain in the project area. However, considering the hydrological condition at Pasak river as described before, the installation of drainage sluice is highly recommendable.

The structure of drainage sluice is designed as reinforce concrete with box culvert type to be provided with steel sluice gate (2.60 m x 2.60 m x 3 rows)

The areas located along the Pak Bang river 12 km far from Rama VI barrage which is a tributary of Pasak river, are also suffered from ill drainage especially in 1964 and 1978. However, these areas are situated at a comparative high portion (MSL 12.00 m in minimum) and at the confluence point of Pak Bang river and Pasak river where has enough cross-section to flow discharge. At present, it seems not necessary to provide for drainage sluice in this point.

Table A.4.5-2 Calculation of Unit Drainage Discharge

Date	Rainfall mm	Mass Rain mm	Runoff Ratio %	Runoff by Single Rain mm	Daily Runoff 1st mm	2nd mm	3rd mm	4th mm	5th mm
(1) Upland Field									
1st	29.0	29.0	10	2.9	2.9	-	-	-	-
2nd	83.4	112.4	80	66.7	-	40.0	20.0	6.7	-
3rd	47.1	159.5	80	37.7	-	-	26.4	11.3	-
4th	21.7	181.2	80	17.4	-	-	-	17.4	-
Total	181.2			124.7	2.9	40.0	46.4	35.4	-
(2) Paddy Field									
1st	29.0	29.0	-	-	-	-	-	-	-
2nd	83.4	112.4	100	12.4*	-	12.4	-	-	-
3rd	47.1	159.5	100	47.1	-	-	33.0	14.1	-
4th	21.7	181.2	100	21.7	-	-	-	21.7	-
Total	181.2				-	12.4	33.0	35.8	-

Unit discharge Upland field = 46.4 mm/day = 5.37 ℓ/s/ha

Paddy field = 35.8 mm/day = 4.14 ℓ/s/ha

* Runoff discharges are computed based on excess water over 100 mm in paddy field

Table A.4.5-3 The Prospected Water Surface at the Confluence of Pasak and Roeng Rang River

Year	Water Surface in MSL			Inundated Area
	S2 gauging Station (m)	Rama VI Barrage (m)	Confluence of Roeng Rang River (m)	(ha)
1971	10.48	7.22	7.44	0
1972	15.40	9.86	10.24	1,120
1973	10.67	7.60	7.81	0
1974	11.45	7.67	7.93	0
1975	13.21	7.98	8.33	100
1976	10.46	7.91	8.07	70
1977	12.29	7.69	8.00	0
1978	21.11	11.90	12.53	5,300
1979	10.56	7.78	7.96	0
1980	13.69	9.59	9.87	780

Note: Water Level of Confluence of Roeng Rang River were calculated by proportional allotments between water levels of S2 gauging station and Rama VI barrage, respectively.

Distance along Pasak River

S2 gauging station ~ Rama VI barrage	51 km
Confluence of Roeng Rang River ~ Rama VI barrage	3.5 km

Table A.4.5-4 Calculation of Runoff Discharge

Formula $$q = \frac{R \times 10{,}000 \times 100A}{1{,}000 \times 86{,}400} \times C$$

Where q : Runoff discharge (m^3/sec)
R : Daily runoff (mm)
A : Drainage area (km^2)
C : Reduction ratio (%)

Date	Paddy Field				Upland Field				Total
	Rp	A	C	qp	Ru	A	C	qu	q
1st	-	93.7	65	-	2.9	92.0	65	2.00	2.00
2nd	12.4	93.7	65	8.74	40.0	92.0	65	27.69	36.43
3rd	33.0	93.7	65	23.26	46.4	92.0	65	32.11	55.37
4th	35.8	93.7	65	25.24	35.4	92.0	65	24.50	49.74

∴ maximum drainage discharge = 55.37 m^3/sec

Table A.4.5-5 The Highest Water Level at S2 Gauging Station and Rama VI Barrage

Year	S2 Gauging Station (m)	Rama VI Barrage (m)
1951	11.38	7.64
1952	11.19	7.62
1953	11.30	7.66
1954	13.86	8.48
1955	11.04	7.74
1956	12.48	7.64
1957	*14.87	*9.56
1958	*12.00	*7.04
1959	14.70	8.72
1960	*11.90	*N.A.
1961	11.43	7.76
1962	N.A.	8.43
1963	14.13	8.96
1964	*19.64	*10.26
1965	12.43	7.66
1966	13.89	8.28
1967	12.44	7.70
1968	*8.76	*7.61
1969	16.45	8.04
1970	12.17	7.78
1971	*10.41	*7.22
1972	*15.40	*9.86
1973	10.68	7.72
1974	11.41	7.86
1975	13.74	7.92
1976	12.81	8.06
1977	13.22	7.76
1978	*21.11	*11.90
1979	11.02	7.78
1980	*13.69	*9.59

Remark

N.A. : Record not available

* : The averaged high water levels were calculated exclusive some specified data.

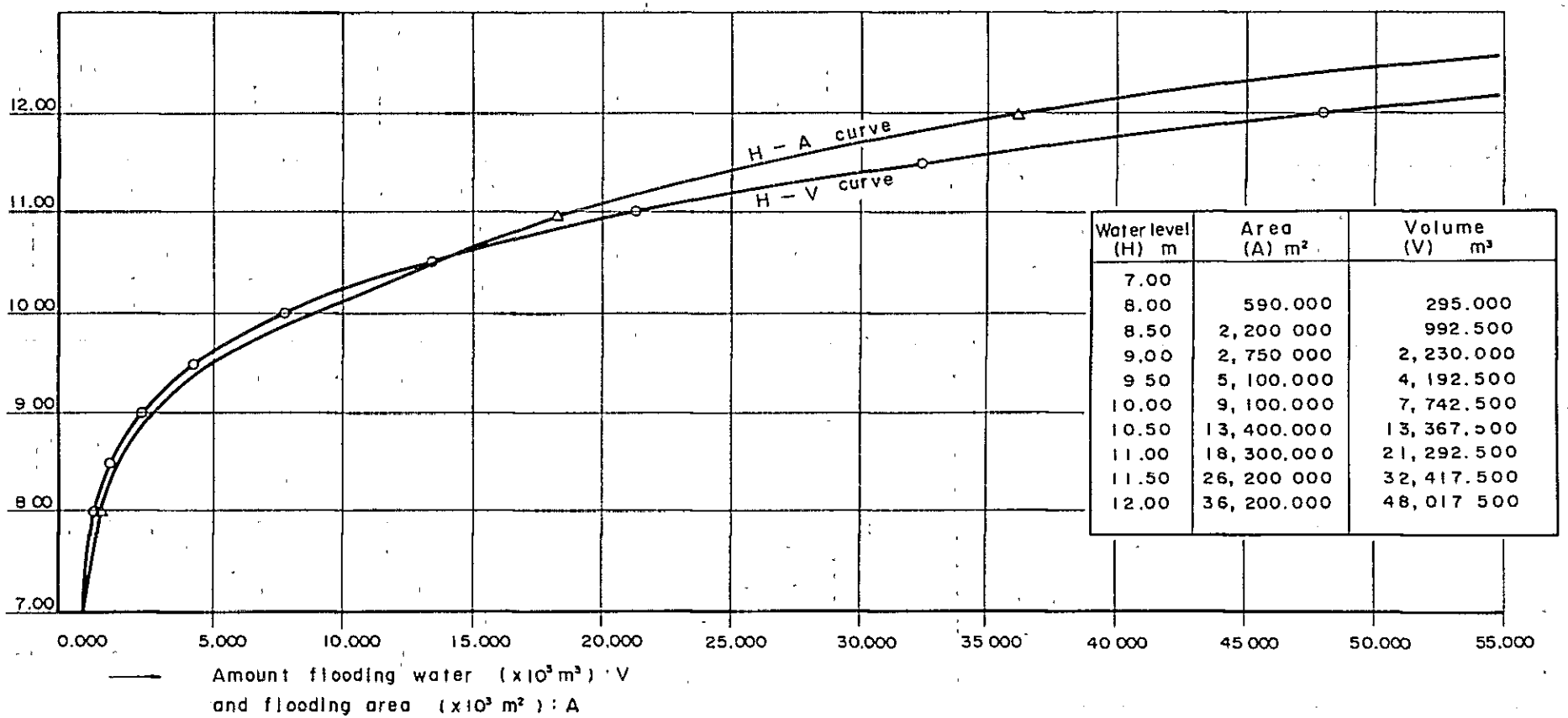
Mean water level at S2 gauging station : 13.19 m

at Rama VI barrage : 7.94 m

at the confluence of Roeng Rang River

: $(13.19 - 7.94) \times \frac{3.5}{51} + 7.94 = \underline{8.30 \text{ m}}$

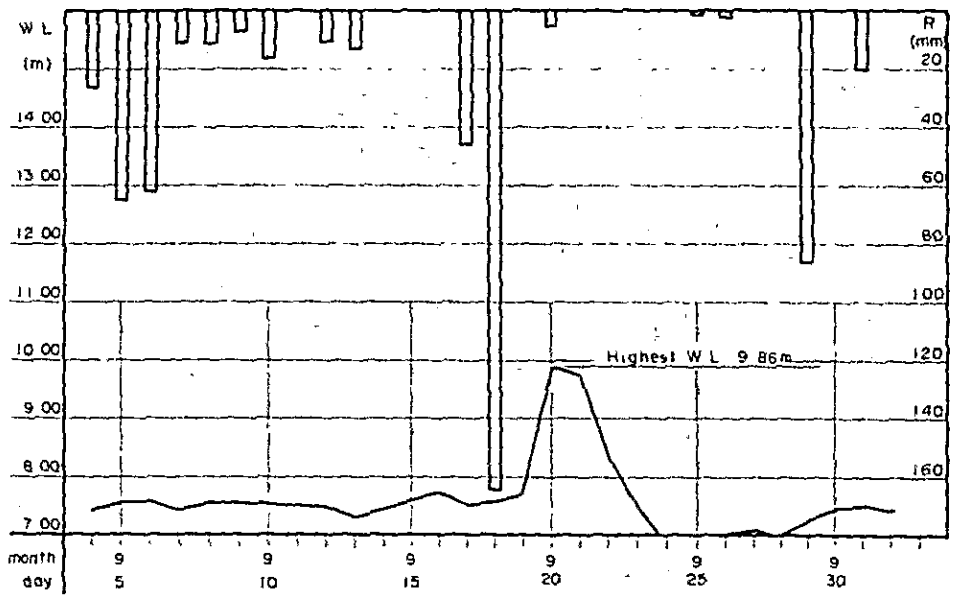
Fig A.4.5-1 Inside water level and Inundation area and / or Volume



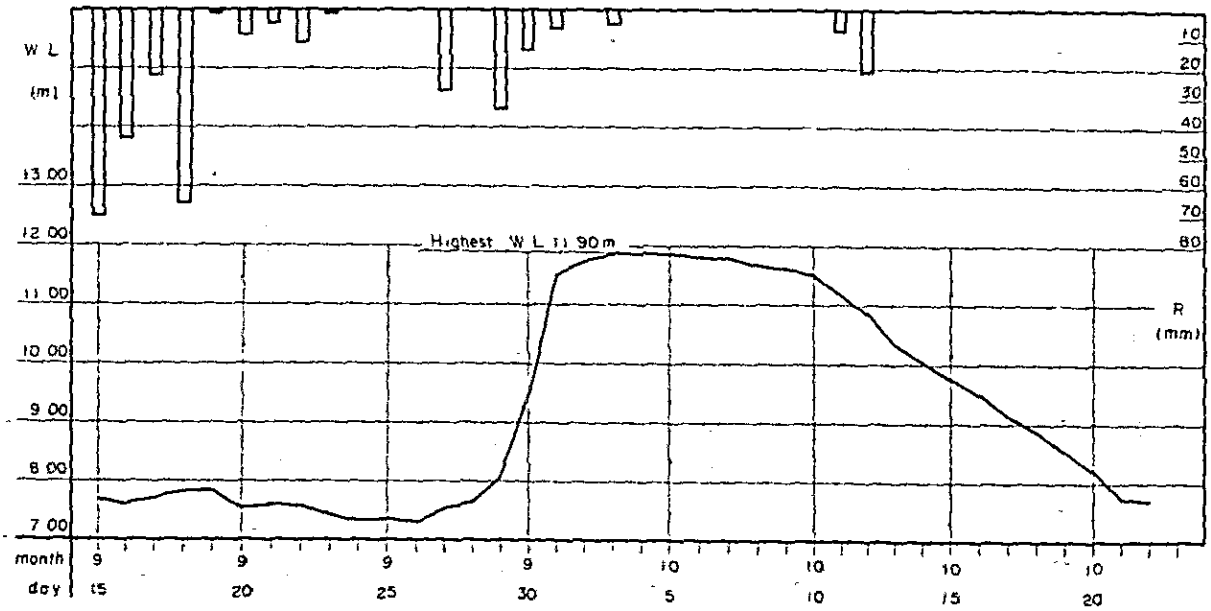
Water level (H) m	Area (A) m²	Volume (V) m³
7.00		
8.00	590.000	295.000
8.50	2,200 000	992.500
9.00	2, 750 000	2, 230.000
9 50	5, 100.000	4, 192.500
10.00	9, 100.000	7, 742.500
10.50	13, 400.000	13, 367.500
11.00	18, 300.000	21, 292.500
11.50	26, 200 000	32, 417.500
12.00	36, 200.000	48, 017 500

Fig.4.5-2 Relation between flood stage of Pasak river and consecutive rainfall in Saraburi

(1) year 1972 (at Rama VI barrage)



(2) year 1978 (at Rama VI barrage)



(3) year 1980 (at Rama VI barrage)

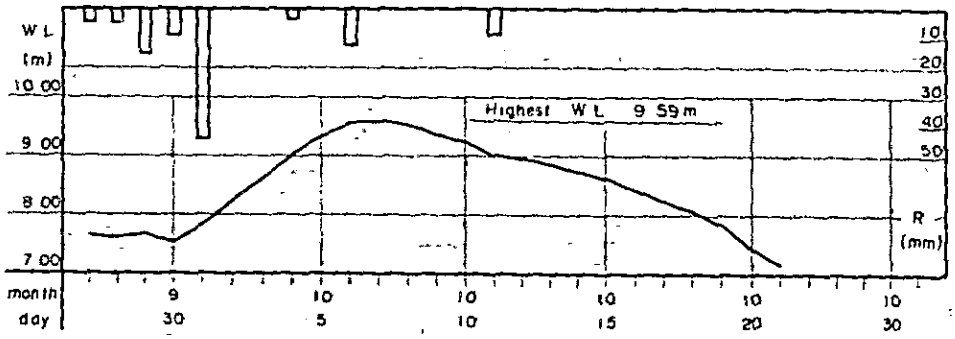
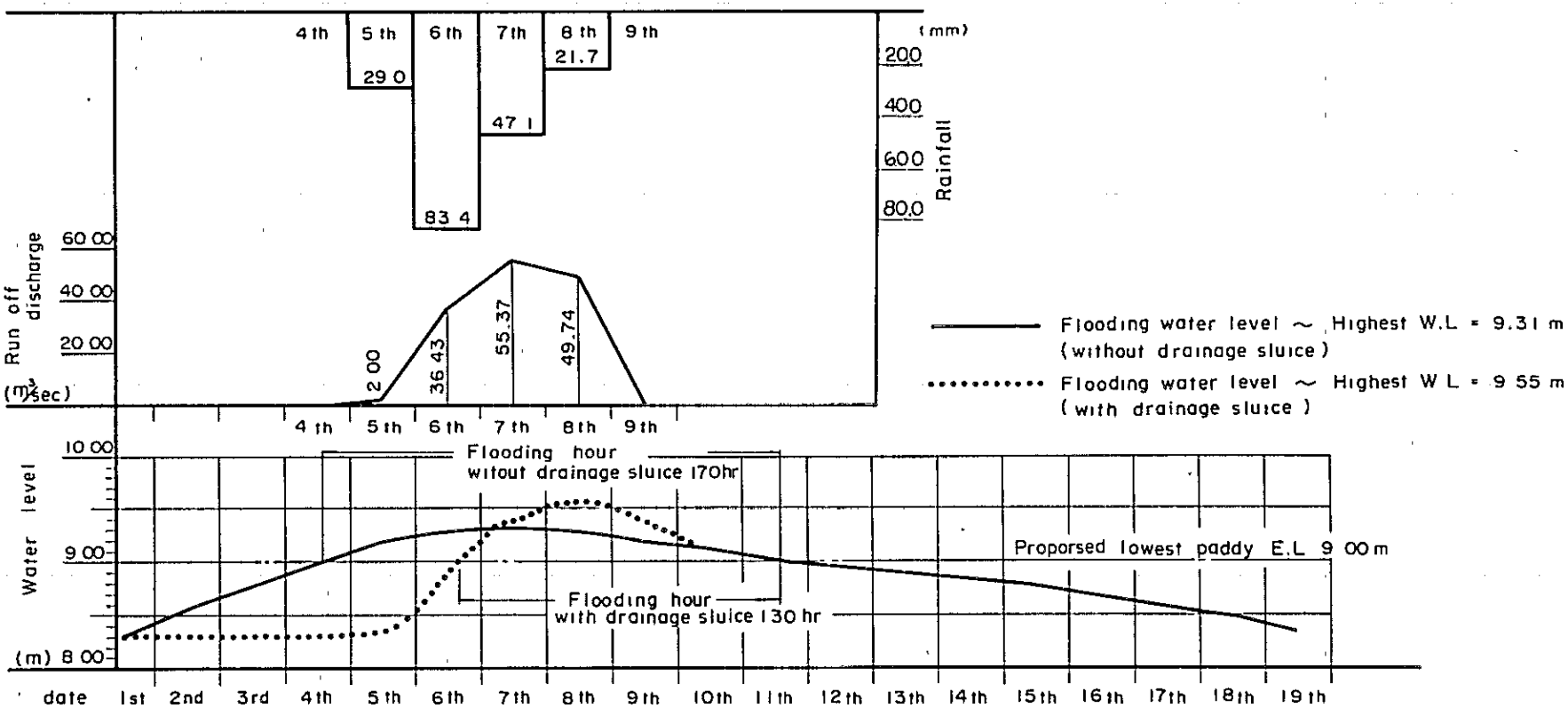


Fig.A.4-5-3 Water balance of drainage sluice



4.6. Demonstration Farm

4.6. Demonstration Farm

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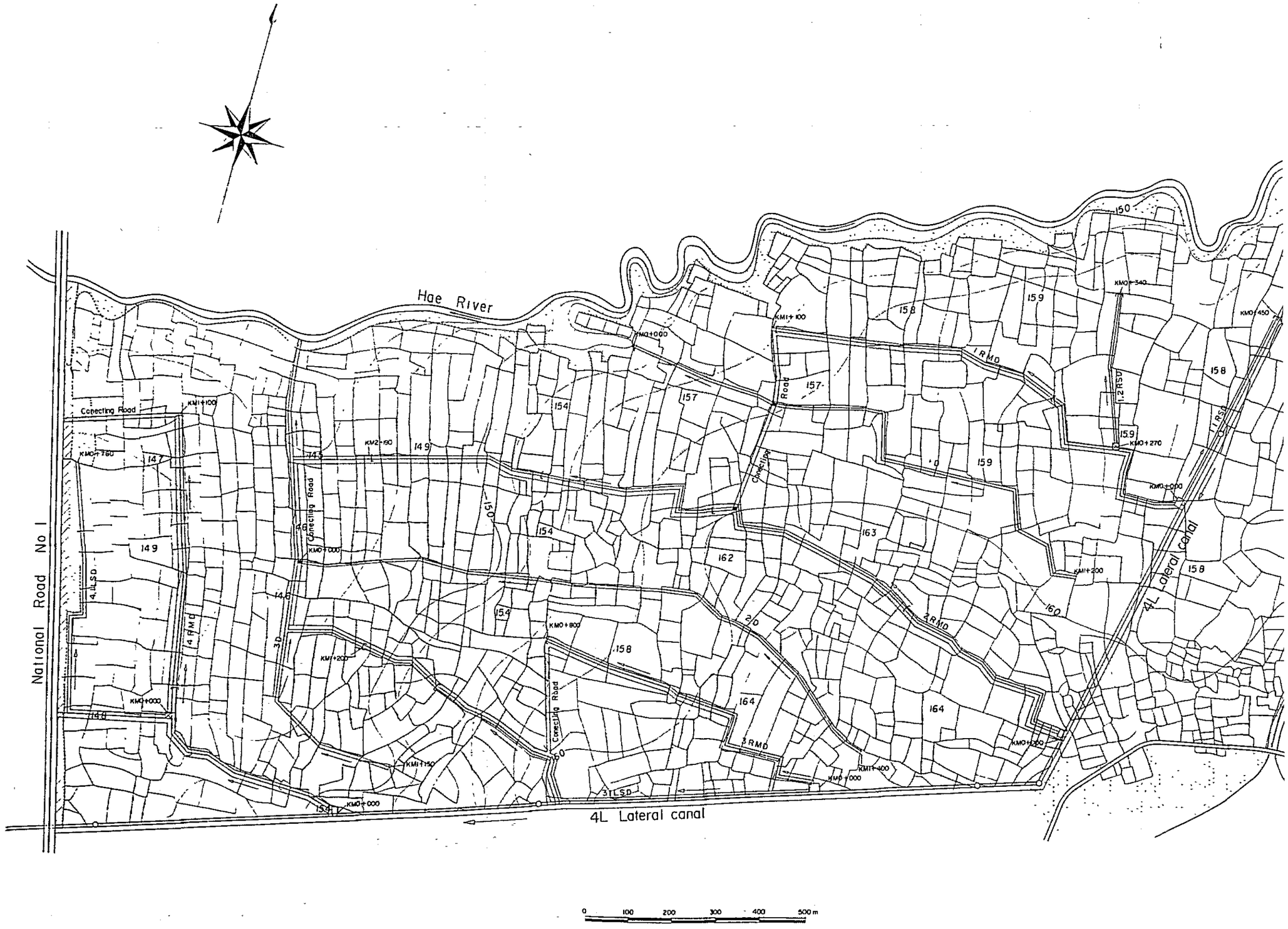
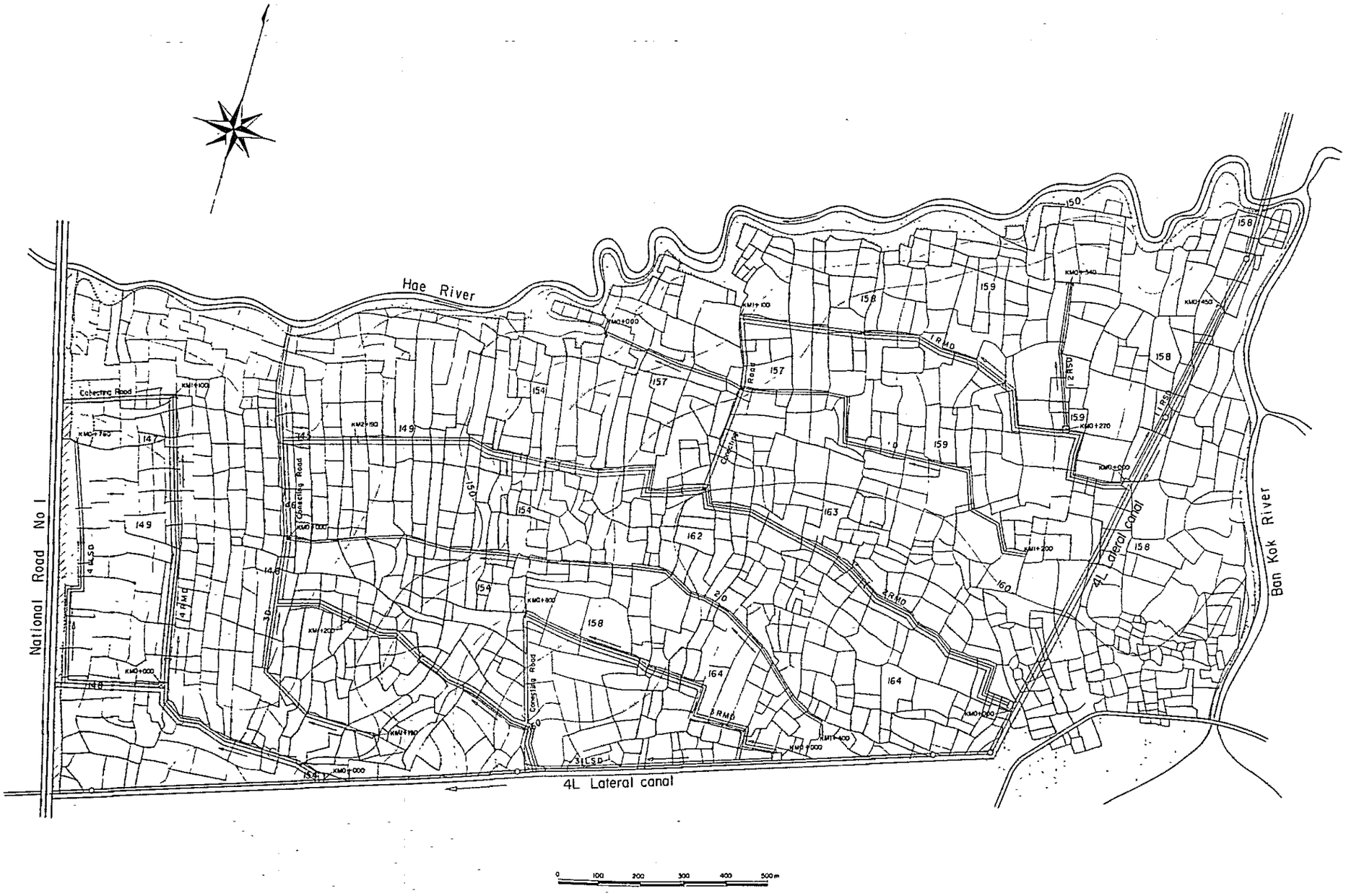
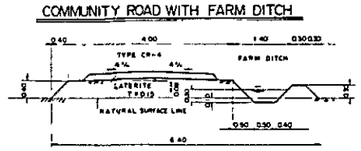
ALTERNATIVE PLAN OF DEMONSTRATION FARM(I)



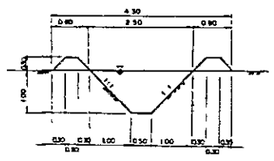
ALTERNATIVE PLAN OF DEMONSTRATION FARM(1)



COMMUNITY ROAD WITH FARM DITCH



DRAINAGE DITCH



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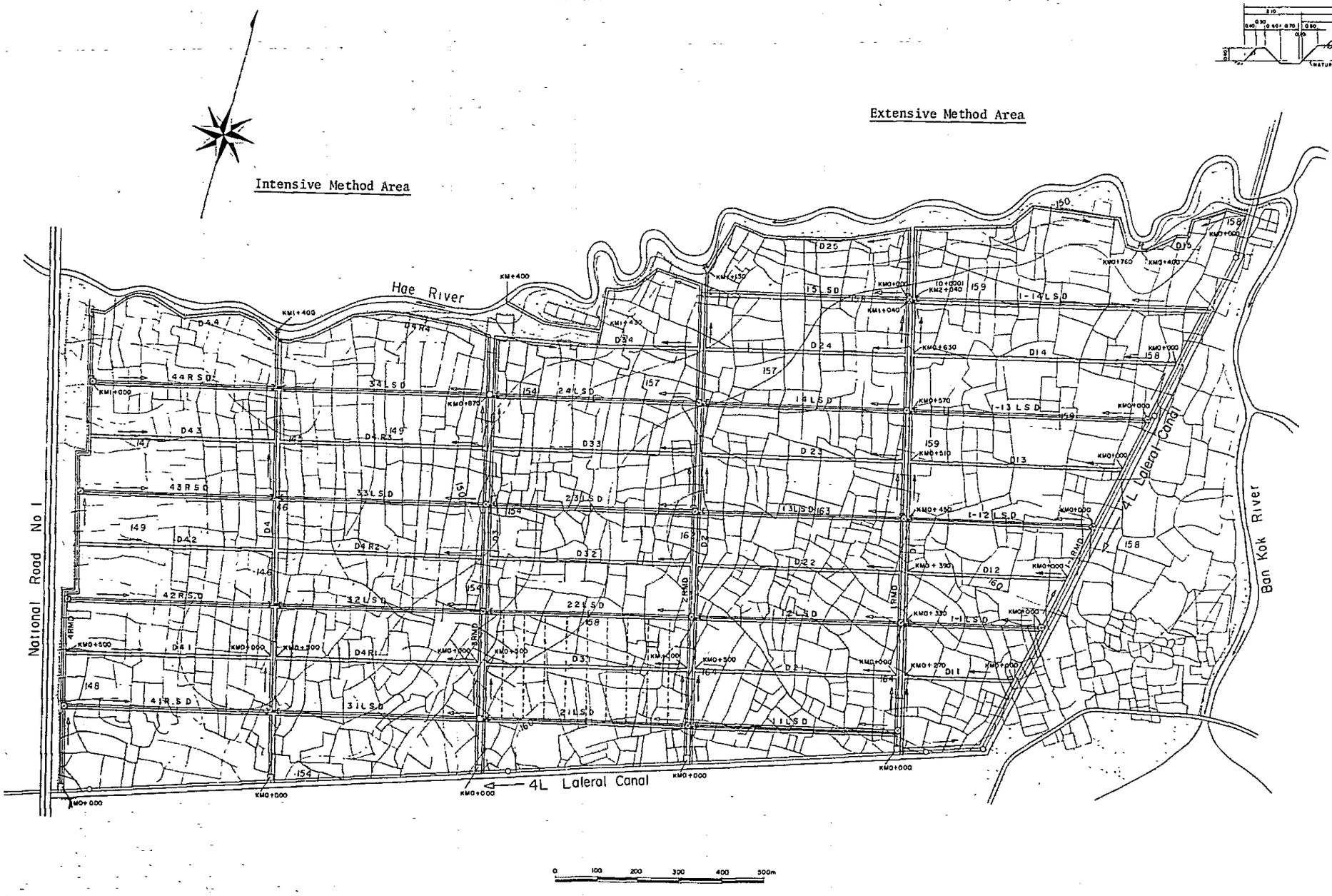
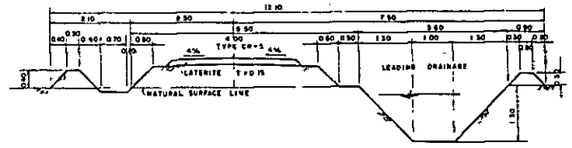
KAENG KHOI — BAN MO PUMPING IRRIGATION PROJECT
ALTERNATIVE PLAN OF DEMONSTRATION FARM (1)
JAPAN INTERNATIONAL COOPERATION AGENCY

Fig A.4.6-1

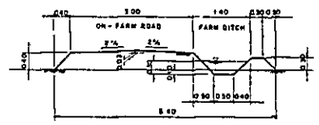
ALTERNATIVE PLAN OF DEMONSTRATION FARM (2)



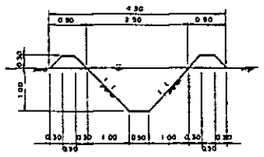
COMMUNITY ROAD WITH LEADING DRAINAGE



ON-FARM ROAD WITH FARM DITCH



DRAINAGE DITCH



Legend

- Farm ditch
- Drainage ditch
- Constant head orifice
- Diversion box
- Check
- Drop
- Pipe culvert
- Box culvert

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Fig A.4.6-2

4.7. Agricultural Development Plan Including Supporting Services

4.7. Agricultural Development Plan Including Supporting Services

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4.7.1 Target Yield

Taking the actual result of the existing irrigation projects mentioned before into account, the proposed yields Table 4-7 in the main report seem conservative as far as better farm management will be practised by farmers than the the present one. All target yields seem to be kept at a little lower level than their potentials, because the proposed irrigation planning is made on the basis of about one-third probable rainfall.

Figure A.3.7-1 shows the result of examination of paddy yield response to N-fertilizer supplied by Suphanburi Rice Experimental Station, for which two regression equations are available. Using the regression equations for the purpose of testing the proposed target yield results in as follows;

Composition of Nitrogen

Wet Season L.V.	Basal	112 kg/ha x 0.16 =	17.9 kg/ha
	Top dressing	79 x 0.20 =	15.8 kg/ha
	Total		33.7 (5.4 kg/rai)
Wet Season H.Y.V.	Basal	102 kg/ha x 0.16 =	16.3 kg/ha
	Top dressing	123 x 0.20 =	24.6 kg/ha
	Total		40 9 (6.5 kg/rai)
Dry Season H.Y.V.	Basal	113 kg/ha x 0.16 =	18.1 kg/ha
	Top dressing	135 x 0.20 =	27.0 kg/ha
	Total		45.1 (7.2 kg/rai)

Expected Yield

Wet Season L.V. $y = 581.29 + (20.44 \times 5.4) - (1.50 \times 5.4^2)$
$= 648.0$ kg/rai (4.05 t/ha)

Wet Season H.Y.V. $y = 548.43 + (22.02 \times 6.5) - (0.41 \times 6.5^2)$
$= 674.2$ kg/rai (4.21 t/ha)

Dry Season H.Y.V. $y = 548.43 + (22.02 \times 7.2) - (0.41 \times 7.2^2)$
$= 685.6$ kg/rai (4.29 t/ha)

It is said that maize has higher response to fertilizers than that of paddy, and the maximum yield of 4.3 ton per ha is recorded in Phra Phutthabat Field Crop Experimental Station, based on which the target yield of maize may not be decided. But according to interview to farmers in the Project Area, an average yield is 2.1 tons per ha and some farmer' yield as much as 2.8 tons per ha.

As to groundnuts yield, Table A.4.7-1 is referred. In case of groundnuts, Nitrogen can be supplied by root nodule bacteria and then it is planned to apply only potassium chloride with dosage of 125 kg per ha. According to Table A.4.7-1 yields without shell of 1,791 kg per ha and 1,799 kg per ha are obtainable with dosage of 75 kg per ha and 150 kg per ha, respectively. Thus, the proposed targe yield of 2.6 tons per ha would be attainable.

Table A.4.7-1 Effect of Potash and Gypsum on the Yield of Unshelled Groundnuts (Mean of 5 replications in kg/ha)

Potassium Chloride		0	37.5	75	150	Mean
Sulphur	0	1,805	1,866	1,791	1,799	1,816
Gypsum	38	1,704	1,584	1,674	1,657	1,655
Mean	-	1,755	1,725	1,133	1,728	

CV % (s) = 7.6 Mean effect of gypsum significant (P = 0.05)
Split plot (K) = 9.5

Source: Coordination of plant production research in Thailand, project working paper No.3 F.A.O.

Table A.4.7-2 Input Materials by Crops

(Unit: kg/ha)

Items	Wet Season					Dry Season
	Paddy(L.V-B.C)	Paddy(L.V-T.P)	Paddy(H.Y.V)	Maize	Groundnuts	Paddy (H.Y.V)
Present						
Seed	90	70	60	18	120	60
Ammophos (16-20-0)	70	74	90	4	4	110
Ammonium Sulfate (N 20%)	70	73	90	-	-	110
Potassium Chloride (K_2O 60%)	-	-	-	-	-	-
Asodrin	-	-	-	6	-	-
Padan Mipcin	0.1	0.1	2.6	-	-	3
Saturn	-	-	-	-	-	-
Without Project						
Seed	90	70	60	18	120	60
Ammophos (16-20-0)	70	74	90	4	4	110
Ammonium Sulfate (N 20%)	70	73	90	-	-	110
Potassium Chloride (K_2O 60%)	-	-	-	-	-	-
Asodrin	-	-	-	6	-	-
Padan Mipcin	0.1	3	3	-	-	3
Saturn	-	-	-	-	-	-
With Project						
Seed	-	55	50	10	110	50
Ammophos (16-20-0), (20-11-11) 1/	-	147	137	200	-	148
Ammonium Sulfate (N 20%)	-	79	123	-	-	135
Potassium Chloride (K_2O 60%)	-	-	-	-	125	-
Asodrin	-	-	-	8	6	-
Padan Mipcin	-	30	30	-	-	30
Saturn	-	15	15	-	-	15

Note. L.V: Local Variety H.Y.V: High Yield Variety B.C: Broadcasting Method
T.P: Transplanting Method 1/: Adopted to Maize

Table A.4.7-3 Unit Labor Requirement

(Unit: manday/ha)

Crops	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Paddy (Wet Season, L.V)													
Present	-	-	-	-	-	0.6	12.8	26.3	2.2	1.7	0.2	40.0	85.8
Without Project	-	-	-	-	-	0.6	13.9	28.3	3.0	2.0	0.5	38.9	87.2
With Project	-	-	-	-	-	0.8	17.5	32.3	5.4	3.7	0.8	39.0	99.5
Paddy (Wet Season, H.Y.V)													
Present	-	-	-	-	-	2.5	13.1	25.9	10.2	1.7	30.9	-	84.3
Without Project	-	-	-	-	-	2.5	13.2	26.0	10.3	1.8	34.9	-	88.7
With Project	-	-	-	-	-	3.0	15.4	30.5	12.0	2.0	36.5	-	99.4
Paddy (Wet Season, L.V)[1/]													
Present	-	-	-	1.9	0.6	1.1	6.8	1.0	27.7	-	-	-	39.1
Without Project	-	-	-	2.0	0.6	1.3	7.0	1.1	27.7	-	-	-	39.7
With Project	-	-	-	-	-	-	-	-	-	-	-	-	-
Maize													
Present	-	-	-	-	21.6	6.7	6.7	17.7	8.9	-	-	-	61.6
Without Project	-	-	-	-	23.0	6.9	6.9	18.2	9.0	-	-	-	64.0
With Project	-	-	-	-	8.1	1.7	4.4	18.1	9.1	-	-	-	41.4
Groundnuts													
Present	-	-	-	-	-	45.9	17.7	17.7	55.8	-	-	-	137.1
Without Project	-	-	-	-	-	47.2	18.3	18.3	57.5	-	-	-	141.3
With Project	-	-	-	-	-	21.9	17.9	17.9	45.1	-	-	-	102.8
Paddy (Dry Season, H.Y.V)													
Present	15.1	22.5	8.8	4.6	30.7	-	-	-	-	-	-	2.8	84.5
Without Project	15.9	23.6	9.2	4.8	32.2	-	-	-	-	-	-	2.9	88.6
With Project	17.7	26.7	10.2	5.2	36.5	-	-	-	-	-	-	3.0	99.3

Note: 1/ Broadcasting

Table A.4.7-4 Monthly Labor Requirement

(Unit: 1,000 mandays)

Crops	ha	Jan.	Feb.	Mar.	Apr.	May	Jun	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Paddy (Wet Season, L.V)														
Present	9,050	-	-	-	-	-	5.4	115 8	238.0	19.9	15.4	1.8	362.0	758.3
Without Project	8,550	-	-	-	-	-	5.1	118.8	242.0	25.7	17.1	4.3	332.6	745.6
With Project	6,840	-	-	-	-	-	5.5	119.7	220.9	36.9	25.3	5.5	266.8	680.6
Paddy (Wet Season, H.Y.V)														
Present	3,160	-	-	-	-	-	7.9	41.4	81.8	32.2	5.4	97.6	-	266.3
Without Project	3,660	-	-	-	-	-	9.2	48.3	95.2	37.7	6.6	127.7	-	324.7
With Project	6,840	-	-	-	-	-	20.5	105.3	308.6	82.1	13.7	249.7	-	679.9
Paddy (Wet Season, L.V)[1/]														
Present	940	-	-	-	1.8	0.6	1.0	6.4	0.9	26.0	-	-	-	36.7
Without Project	940	-	-	-	1.9	0.6	1.2	6.6	1.0	26.0	-	-	-	37.3
With Project	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Maize														
Present	410	-	-	-	-	8.9	2.7	2.7	7.3	3.6	-	-	-	25.2
Without Project	410	-	-	-	-	9.4	2.8	2.8	7.5	3.7	-	-	-	26.2
With Project	430	-	-	-	-	3.5	0.7	1.9	7.8	3.9	-	-	-	17.8
Groundnuts														
Present	50	-	-	-	-	-	2.3	0.9	0.9	2.8	-	-	-	6.9
Without Project	50	-	-	-	-	-	2.4	0.9	0.9	2.9	-	-	-	7.1
With Project	50	-	-	-	-	-	1.1	0.9	0.9	2.3	-	-	-	5.2
Paddy (Dry Season, H.Y.V)														
Present	680	10.3	15.3	6.0	3.1	20.9	-	-	-	-	-	-	1.9	57.5
Without Project	680	10.8	16.0	6.3	3.3	21 9	-	-	-	-	-	-	2.0	60.3
With Project	2,800	49.6	74.8	28.6	14.6	102.0	-	-	-	-	-	-	8.4	278.0
Total														
Present	14,290	10.3	15 3	6.0	4.9	30.4	19.3	167.2	328.9	84.5	20.8	99.4	363.9	1,150.9
Without Project	14,290	10.8	16.0	6.3	5.2	31.9	20.7	177.4	346.6	96.0	23.7	132.0	334.6	1,201.2
With Project	16,960	49.6	74.8	28.6	14.6	105.5	27.8	227.8	438.2	125.2	39.0	255.2	275.2	1,661.5

Note: 1/ Broadcasting

Table A.4.7-5 Operation Schedule of Agricultural Machinery

Items	Machine	Area ha
Wet Season		
Paddy		
Nursery		
L.V Plowing	Two Wheel Tractor	547
Puddling	"	547
H.Y.V Plowing	Two Wheel Tractor	547
Puddling	"	547
Paddy Field		
L.V Plowing	Two Wheel Tractor	6,840
Puddling	"	6,840
Threshing	Thresher	6,840
H.Y.V Plowing	Two Wheel Tractor	6,840
Puddling	"	6,840
Threshing	Thresher	6,840
Maize Plowing	Tractor, One Way Harrow	430
Harrowing	" "	430
Ridging	" , Ridger	430
Groundnuts		
Plowing	Tractor, One Way Harrow	50
Harrowing	" "	50
Ridging	" , Ridger	50
Dry Season		
Paddy (H.Y.V)		
Nursery		
Plowing	Two Wheel Tractor	224
Puddling	"	224
Paddy Field		
Plowing	Two Wheel Tractor	2,800
Puddling	"	2,800
Threshing	Thresher	2,800

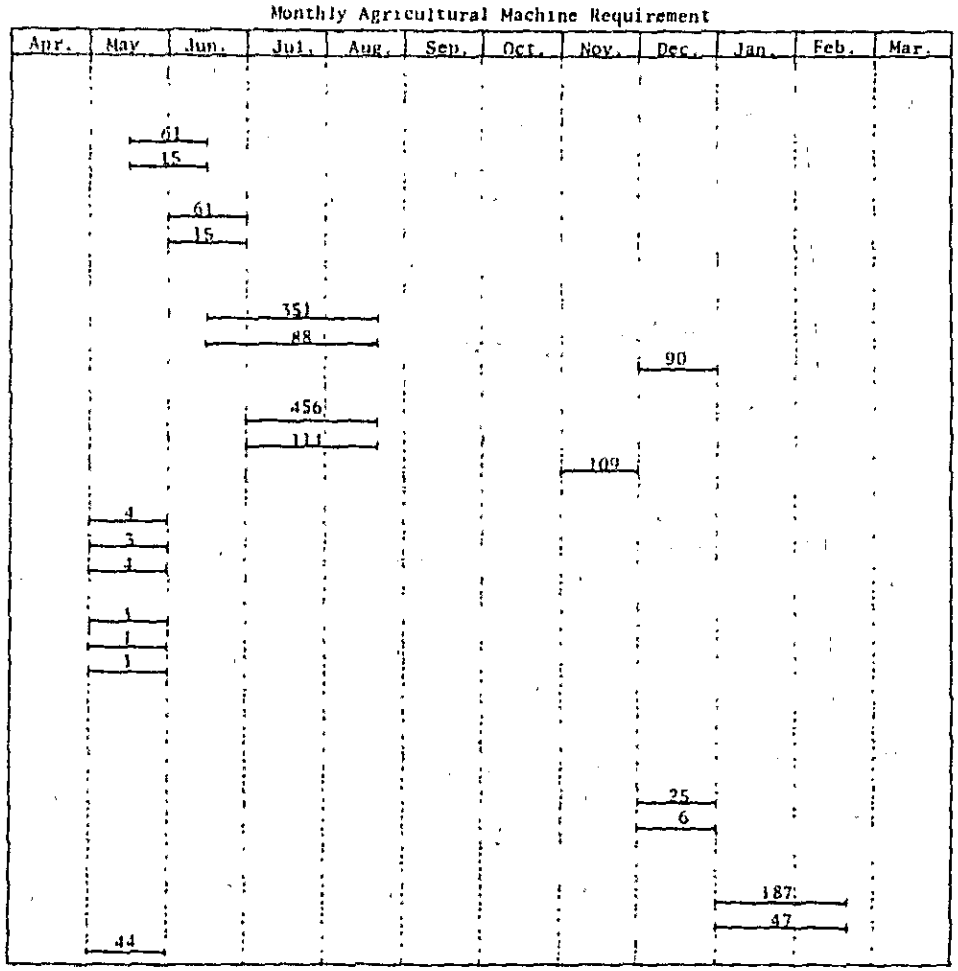

Table A.4.7-6 Requirement of Agricultural Machinery

Items	Machine	Operation Period days	Area ha	Number of Machines Required	Remarks
Wet Season					
Paddy					
Nursery					
L.V Plowing	Two Wheel Tractor	30	547	547 ÷ 30 ÷ 0.3 = 61	
" Puddling	"	30	547	547 ÷ 30 ÷ 1.2 = 15	
H.Y.V Plowing	"	30	547	547 ÷ 30 ÷ 0.3 = 61	
Puddling	"	30	547	547 ÷ 30 ÷ 1.2 = 15	
Paddy Field					
L.V Plowing	Two Wheel Tractor	65	6,840	6,840 ÷ 65 ÷ 0.3 = 351	
Puddling	"	65	6,840	6,840 ÷ 65 ÷ 1.2 = 88	
Threshing	Thresher	30	6,840	(6,840x3.3) ÷ (1.2x7x30) = 90	
H.Y.V Plowing	Two Wheel Tractor	50	6,840	6,840 ÷ 50 ÷ 0.3 = 456	
Puddling	"	50	6,840	6,840 ÷ 50 ÷ 1.2 = 114	
Threshing	Thresher	30	6,840	(6,840x4.0) ÷ (1.2x7x30) = 109	
Maize Plowing	Tractor, One Way Harrow	30	430	430 ÷ 30 ÷ 3.6 = 4	
Harrowing	" "	30	430	430 ÷ 30 ÷ 4.5 = 3	
Ridging	Tractor, Ridger	30	430	430 ÷ 30 ÷ 3.5 = 4	
Groundnuts Plowing	Tractor, One Way Harrow	30	50	50 ÷ 30 ÷ 3.6 = 1	
Harrowing	" "	30	50	50 ÷ 30 ÷ 4.5 = 1	
Ridging	Tractor, Ridger	30	50	50 ÷ 30 ÷ 3.5 = 1	
Dry Season					
Paddy (H.Y.V)					
Nursery Plowing	Two Wheel Tractor	30	224	224 ÷ 30 ÷ 0.3 = 25	
Puddling	"	30	224	224 ÷ 30 ÷ 1.2 = 6	
Paddy Field					
Plowing	Two Wheel Tractor	50	2,800	2,800 ÷ 50 ÷ 0.3 = 187	
Puddling	"	50	2,800	2,800 ÷ 50 ÷ 1.2 = 47	
Threshing	Thresher	30	2,800	(2,800x4t) ÷ (1.2x7x30) = 44	

Table A.4.7-7 Working Capacities of Each Machinery

Name of Machine	Operation Width (1) m	Operation Speed (2) km/hr	Theoretical Operation Capacity (1)x(2)/10=(3) ha/hr	Efficiency in Field (4) %	Operation Capacity in Field (3)x(4)=(5) ha/hr	Required Hours per ha (6)	Working Capacity in a day (7) ha/day
Two wheel Tractor (8 - 10ps)							
Plowing	0.57	1.4	0.08	89	0.07	14.29x2=28.58 (30.0)	0.30
Puddling	1.43	2.9	0.41	82	0.34	2.94x2=5.88 (6.0)	1.20
One Way Harrow 26"x7							
Plowing	1.70	4.0	0.68	75	0.51	1.96 (2.2)	3.60
Puddling	1.70	5.0	0.85	75	0.64	1.56 (1.8)	4.50
Ridger 3 rows	1.80	4.0	0.72	70	0.50	2.00 (2.3)	3.50
Duster	4.00	2.0	0.80	60	0.48	2.08 (2.4)	3.36
Granule Spreader	3.00	2.3	0.69	60	0.41	2.44 (2.7)	2.87
Hand Sprayer	2.00	2.7	0.54	75	0.41	2.44 (2.4)	2.87
Hand Fertilizer	4.00	2.0	0.80	60	0.48	2.08 (2.2)	3.36
Transplanting by man	-	-	-	-	0.006	166.00	0.04
Pulling	0.50	2.5	0.13	80	0.10	10.00	0.70
Hauling	0.50	2.0	0.10	60	0.06	16.67	0.42
Sowing by hand (Paddy)	0.60	2.5	0.15	80	0.12	8.33	0.84
" (Maize)						48.00	0.15
" (Groundnuts)						145.00	0.05
Weeding by hand						33.30	0.21
Harvesting (Paddy)						166.70	0.04

Table A.4.7-8 Operation Cost of Each Machinery

Machine	Cost ฿	Durable Hours hour	Residual[1] Cost ฿	Depreciable Cost per Hour ฿	Repairing[2] Cost per Hour ฿	Cost for Garage[3] per Hour ฿	Fixed Cost per Hour ฿	Oil Consumption per Hour ℓ	Oil Cost ฿	Operation Cost per Hour ฿
Tractor (35HP)	190,000	5,000	19,000	34.2	79.8	5.7	85.5	4.0	10	125.5
One Way Harrow	24,000	1,500	2,400	14.4	10.1	0.7	25.2	-	-	25.2
Ridger	30,000	1,500	3,000	18.0	12.6	0.9	31.5	-	-	31.5
Two Wheel Tractor	25,000	1,200	2,500	18.8	10.5	0.8	30.1	1.5	10	45.1
Trailer	20,000	1,600	2,000	11.3	8.4	0.6	20.3	-	-	20.3
Duster	4,600	1,000	460	4.1	1.9	0.1	6.1	-	-	6.1
Thresher	30,000	1,000	3,000	27.0	12.6	0.9	40.5	0.5	8	44.5
Hand Fertilizer	4,600	800	460	5.2	1.9	0.1	7.2	-	-	7.2

Note: 1/ 10%
2/ 0.042%
3/ 0.003%

Tractor + one way Harrow = 150.7 ฿/hr
Tractor + Ridger = 157.0
Two Wheel Tractor + Trailer = 65.4

4.8. Cost Estimate

4.8. Cost Estimate

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4.8.1. Construction Planning

A. Work Items

The Project involves construction of a pumping station and a canal network to avail irrigation water from the Pasak River and to distribute to the beneficiary areas. Major work items under the project consist of the followings:-

a.	Pumping station	:	Mixed flow, vertical type
			ϕ1,000 m/m x 560 KW x 7 Units
		:	Suction pool 24 m x 36 m x 21 m
		:	Delivery pool 24 m x 22 m x 4 m
		:	Housing space 40 m x 12.5 m
b.	Irrigation canal:		Main canal 35,350 m
			Lateral canal 112,225 m
c.	Drainage canal	:	Main canal 21,800 m

B. Construction Period

Project period shall cover seven (7) years from 1982 to 1988. The initial year of 1982 and 1983 is for detailed design, various preparatory works and land acquisition, making the actual period for construction work to be five (5) years of 1984 - 1988.

C. Prevailing Conditions in view of Construction Work

C.1. Rainfall

Rainfall in the area is concentrated in the wet season (May - October) and usually flood damages are observed in the months of September and October. The same season is for wet season paddy cropping in the area and all the paddy fields are covered with water. This situation makes it difficult to carry out canal construction works, therefore, a period of six (6) months from January to June shall the construction period under the present project implementation.

C.2. Road

In the Project area, four (4) paved roads are existed for North - South connection. Out of which, three (Route 1, 3022 and 3028) are national road and the rest is of provincial road with at least the width for double tracks. While in the central part of the project area, there is Route 3048 connecting east to west the Route 1 with the O & M road along the Chainat Pasak canal at the terminal point. Other than these, there are considerable number of local roads and farm roads connected with the said main roads, though the road surface is not in good condition. For project construction purpose, such existing roads shall be partly rehabilitated or widened for more smooth transportation.

C.3. Power

In the project area, a pumping station is existed for which electricity is the source of power. For the construction works

under the present project, therefore, electricity is available. Taking into account the economy in the power source, since canal construction is the main item of work and temporary facilities to avail electricity might be rather costly.

C.4. Required water for construction work

There found several wells in the northern part of the area, while every house in the southern area is provided with facility to store rain water. Under the circumstances, it seems rather difficult to secure required water for construction works in the project area. From this viewpoint, the water be supplied through pumping up from the Pasak River.

C.5. Others

Concrete aggregate is available at the northern part of the area located along the Route 1. Further, the project area is connected with Bangkok with about 110 km. distance by Route 1, making mobilization of equipment and various materials quite convenient. In view of the above, it can be said that prevailing conditions for construction work in the project area is, in general, quite fair.

D. Construction Equipment

Various construction equipment required for project implementation shall be carefully selected so as to attain smooth progress in actual works. From the nature of works under the project implementation plan and those characteristics of each equipment, the following equipment be recommended.

Excavation works	:	Bulldozer, Backhoe-shovel
Hauling works	:	Bulldozer
Compaction works	:	Tamping-roller, Tire-roller

E. Construction Plan

E.1. Pumping station

Two (2) years period shall be scheduled for construction of the pumping station. In the first year (1984), foundation shall be completed and the second year (1985) construction includes pump house, driving channel and installation and running test of pump set. For excavation and hauling, a combination of 0.6 m^3 backhoe-shovel, wheel loader, 15t. bulldozer and 8t. dump truck shall be employed. Excavated material shall be hauled to spoil dump except those to be deposited nearby and be used for back-filling afterwards. After excavation completed, concrete be placed. Concrete shall be transported to the site by 1.5 m^3 agitator truck from the mixing plant provided nearby. After taking sufficient concrete curing time, back-filling be made one after another. Work order is as illustrated in Figure A.4.8-2.

E.2. Canal

Surface stripping is to be made on canal/road route by using 15t. bulldozer. Stripped earth material be disposed at the neighboring sites. After surface stripping, embankment material be brought in from side borrow pit by using 1.2 or 0.6 m^3 backhoe-shovel with 15t. bulldozer and be compacted by tamping roller. Then, backhoe-shovel work for rough excavation of canal section and finally reshaped by manpower, concrete shall be placed at the places where final shaping be completed. For concrete placing, 0.3 m^3 class pot mixer be used mobilizing from place to place. Work order can be illustrated in Figure A.4.8-1.

Where canal crosses with the existing roads, construction work shall be completed a half section after another half section in case if the road provided with double tracks or more. If the road is with a single track, the works be undertaken at once for the whole section. For drainage channels too, the same manner of construction be applied with providing a coffer dam.

E.3. Related structure

There are various structures to be constructed in connection with the main and lateral irrigation canals. Those structures located under the canal shall be completed prior to canal construction and those to be installed on the canal be completed later on. For both cases, excavation shall be made by 0.35 m^3 backhoe-shovel and manpower and concrete be placed with using 0.3 m^3 pot mixer. For back-filling, rammer be used by manpower.

4.8.2. Comparison on Construction Method and Project Years

A. Comparison of Construction Method

As a reference of the consideration on project implementation program, following alternatives are set up to compare with the original plan which was adopted Contract Basis for most items of construction works.

° Alternative No.1

Construction works of all irrigation canal system are implemented by Force Account basis except on-farm level.

° Alternative No.2

Construction works of main irrigation canal are conducted by Force Account basis and remainder by Constract basis.

The detailed breakdown is tabulated in Table A.4.8-12, and summarized comparisons are shown as follows;

(Unit: ฿1,000)

Items	Foreign Amount	Foreign %	Local Amount	Local %	Total Amount
Original	373,346	39.9	562,454	60.1	935,800
Alt. No.1	424,285	44.1	537,619	55.9	961,904
Alt. No.2	409,776	42.6	553,034	57.4	962,810

B. Alternative of Project Year

As a reference of the project implementation program, if actual construction period are allocated with only three years, the yearly budget allocation and total project cost are tabulated as following table and detailed breakdown are shown in Table A.4.8-13.

Yearly Budget Allocation

(Unit: ฿1,000)

Fiscal Year	Foreign	Local	Total	Proportion (%)
1982	-	4,591	4,591	0.5
1983	10,656	20,211	30,867	3.5
1984	137,419	138,875	276,294	31.7
1985	111,554	218,342	329,896	37.8
1986	90,693	138,579	229,272	26.5
Total	350,322	520,597	870,919	100.0
(Proportion)	(40.2%)	(59.8%)	(100%)	

Table A.4.8-1 Comparison of Labor Cost

Personal	Unit	Cost (Unit : ฿) RID	Phitsanulok irri-project	Chao-phya Project	Kaeng Khoi Project	Remarks
Worker	Day	60	47(62.7)	49.55	50	-
Chief worker	"	150	-	124.55	125	-
Skilled worker	"	85	-	57.85	60	-
Foreman	"	90	92(124)	73.25	75	-
Vehicle driver	"	90	55(76.2)	73.25	75	-
Vehicle driver Asst	"	80	-	66.75	65	-
Heavy equipment Operator	"	130	56(77.5)	108.90	110	-
Heavy equipment Asst	"	80	-	66.75	65	-
Mason	"	90	-	49.55	75	-
Capenter	"	90	-	49.55	75	-
Smith	"	85	-	57.85	60	-
Painter	"	110	-	93.50	95	-
Asphalt worker	"	115	-	98.50	100	-
Watchman	"	85	-	57.85	60	-

Table A.4.8-2 Comparison of Material Cost

Description	Unit	Cost					
		RID	Phitsanulok irrig project	Chao phya Project	Kaeng Khoi Project	FC	LC
Portland cement	Ton	1,600	1,620	1,426	1,600	320	1,280
Sand	Cu-m	180	105	94	180	-	180
Gravel	"	180	240	164	180	-	180
Deformed bar	Ton	11,270	10,500	11,270	11,300	6,780	4,520
Round bar	"	10,190	-	10,189	10,200	6,120	4,080
Miscellaneous steel	Kg	12	14	12	14	8	6
Gasolin (for truck)	Litter	12	11.63	11	12	9	3
Diesel fuel (for generator)	"	10	-	9	10	7.5	2.5
"	"	8	7.62	8	8	6	2
Lubricating oil	"	24	-	23	24	18	6
Wood	Cu-m	-	-	-	5,300	-	5,300
Slft-timeber	"	5,984	5,400	8,476	6,000	-	6,000
Hard-timeber	"	8,096	8,700	12,788	8,100	-	8,100
Sodding	Sq-m	10	-	12	10	-	10
Pitching stone	Cu-m	485	-	420	485	-	485
Laterite	"	75	-	173	75	-	75

Note : Rate of FC & LC

	FC	LC
Cement	20%	80%
Fuel	75%	25%
Steel	60%	40%

Table A.4.8-3 Unit Price of Equipments

(Unit : ฿ 1,000)

Name	Specification	Unit Price	Remarks
Bulldozer	15^{t} 140ps	1,400	
"	16^{t} 140ps(swanpy)	1,620	
Backhoe shovel	0.6 m^{3} 100ps	1,400	
"	0.35 m^{3} 80ps	1,000	
Wheel loader	1.5 m^{3} 100ps	1,080	
"	1.2 m^{3} 80ps	780	
Tamping rollor	3^{t}(G-weight 5.5^{t})	240	
Tire rollor	6^{t} 45ps	900	
Motor grader	3.7 m 125ps	1,080	
Dump truck	8^{t} 240ps	500	
Agitator truck	1.5 m^{3} 150ps	400	
Water tank truck	6,000$^{\ell}$ 170ps	360	
Fuel truck	6^{t} 170ps	480	
Concrete-M-plant	0.5 m^{3} 45kw	950	
Concrete mixer	0.3 m^{3} 12ps	60	
Concrete vibrator	38 m/m 5ps	15	
Generator	60 kva 75ps	210	
Rammer	80 kg 4ps	30	
V-P-Compactor	70 kg 4ps	25	
Belt comveyer	7 m 3ps	25	
Pump	4" 6ps	40	
Jeep	110ps	180	
Pick-up	1.5^{t} 85ps	120	
Motor cycle	100cc	20	

Table A.4.8-4 Comparison of Unit Cost on Construction Equipment (Unit : ฿ 1,000)

Name	Specification	Unit Price RID	Chao Phya Project	SSIP	Kaeng Khoi Project
Bulldozer	1st 140ps*	1,564	1,600	1,392	1,400
"	16t (Swanpy) 140ps	-	1,650	1,620	1,620
Backhoe shovel	0.6 m^3 100ps*	1,160~1,910	1,400	-	1,400
"	0.35 m^3 80ps	-	-	-	1,000
Wheel loader	1.5 m^3 100ps	810	1,200	1,080	1,080
"	1.2 m^3 80ps	-	-	-	780
Tamping rollor	3t (G-weight 5.5t)	-	-	240	240
Tire rollor	6t 45ps	-	900	-	900
Motor grader	3.7 m 125ps	1,380	1,500	1,080	1,080
Dump truck	8t 240ps*	650	400	380	500
Agitator truck	1.5 m^3 150ps	-	-	-	400
Water tank truck	6,000ℓ 170ps*	324	400	360	360
Fuel truck	6t 170ps	-	420	476	480
Concrete mixing plant	0.5 m^3 45kw	-	-	-	950
Concrete mixer	0.3 m^3 12ps	-	100	36	60
Concrete vibrator	38 m/m 5ps*	11	15	-	15
Generator	60 kva 75ps	175	-	-	210
Rammer	80 kg 4ps	20	30	36	30
Vibration plate compactor	70 kg 4ps	11	35	-	25
Belt conveyer	7 m 3ps	-	-	-	25
Pump	4 " 6ps	54	20	-	40
Jeep	110ps	-	180	-	180
Pick-up	1.5t 85ps	-	120	-	120
Motor-cycle	100 cc	-	20	-	20

Note : * = 1980

Table A.4.8-5 Depreciation Cost of Equipment

Name	(1) Purchase Price ¥ 1,000	(2) Life time (Hr)	(3) Depreciation cost Rate	(3) Depreciation cost (1-rate)x(1)/(2)	(4) Tire Cost	(5) Tire cost Life time	(5) Tire cost (4)/L-time	(5) Tire cost Rate	Repair cost (6) (3)xratex0.7	Repair cost (7) (3)xratex0.3	Total F.C. (3)+(5)+(6)	Total L.C. (7)	Total
Bull 21t.	2,200	10,000	-	187	-	-	-	-	131	56	318	56	
" 15t.	1,400	"	0.15	119	-	-	-	1.0	83	36	202	36	238
" 16t. (S.Type)	1,620	"	"	138	-	-	-	"	97	41	235	41	276
" 1.2 m^3	3,200	"	-	272	-	-	-	-	190	82	462	82	-
B-shovel 0.6m^3	1,400	"	0.15	119	-	-	-	1.0	83	36	202	36	238
" 0.35m^3	1,000	"	"	85	-	-	-	"	60	25	145	25	170
W-loader 1.5m^3	1,080	"	"	92	48,000	3,000	16	"	64	28	172	28	200
" 1.2m^3	780	"	"	66	40,000	"	13	"	46	20	125	20	145
Tamping-R 3t.	240	"	"	20	-		-	0.75	11	4	31	4	35
Tire-R 6t.	900	"	"	77	28,000	3,000	9	"	41	17	127	17	144
M-grader 3.7m^3	1,080	"	"	92	33,000	2,000	17	0.9	58	25	167	25	192
Dump-T 8t.	500	"	"	43	"	"	"	0.75	22	10	82	10	92
Agitator-T 1.5m^3	400	"	"	34	25,000	"	13	"	18	8	65	8	73
Water-T 6,000 ℓ	360	"	"	31	"	"	"	"	16	7	60	7	67
Fuel-T 6t.	480	"	"	41	"	"	"	"	22	9	76	9	85
Concrete plant 0.5m^3	950	6,000	0.10	143	-	-	-	0.5	50	22	192	22	215
Concrete mixer 0.3m^3	60	D 600	"	D 90	-	-	-	"	D 32	D 13	D 122	D 13	D135
Conc.-Vibrator 38m/m	15	D 400	"	D 54	-	-	-	0.2	D 5	D 2	D 39	D 2	D 41
Generator 61 KVA	210	D1,050	0.15	D170	-	-	-	0.5	D 60	D 25	D 230	D 25	D255
Rammer 80 Kg.	30	D 400	0.10	D 68	-	-	-	0.2	D 10	D 4	D 78	D 4	D 82
V-P-Compactor 70Kg.	25	D 400	"	D 56	-	-	-	"	D 8	D 3	D 64	D 3	D 67
Belt conveyer 7m.	25	D 400	"	"	-	-	-	"	D 8	D 3	D 64	D 3	D 67
Pump 4"	40	D 650	"	D 55	-	-	-	0.9	D 35	D 15	D 90	D 15	D105

Table A.4.8-6 Operation Cost of Equipment

Name	Labor					Fuel			Lubricating oil			Total			
	Ope.	Asst.	Repair	Worker	(1) Total	ℓ/day	(2) F.C.	(3) L.C.	Rate	(4) F.C. (2)xrate	(5) L.C. (3)xrate	Labor L.C.	Fuel F.C.	Fuel L.C.	equipment F.C.
B-21t.	110	65	392	-	567	235.2	1,764	588	-	706	235	567	2,470	523	2,226
B-15t.	"	"	252	-	427	156.8	1,176	392	0.4	470	157	427	1,646	549	1,414
B-16t.	"	"	287	-	462	"	"	"	"	"	"	462	"	"	1,645
B-S 1.2m^3	"	"	574	-	749	126.4	1,848	616	-	739	246	749	2,587	862	3,234
B-S o.6m^3	"	"	252	-	427	112.0	840	280	0.4	339	112	427	1,176	392	1,414
B-S 0.35m^3	"	"	175	-	350	89.6	672	224	"	269	90	350	941	314	1,015
W-L 1.5m^3	"	"	196	-	371	112.0	840	280	"	336	112	371	1,176	392	1,204
W-L 1.2m^3	"	"	140	-	315	89.6	672	224	"	269	90	315	941	314	875
Tamp-R 3t.	-	-	28	-	28	-	-	-	-	-	-	28	-	-	217
Tire-R 6t.	110	65	119	-	294	31.5	236	79	0.2	47	16	294	283	95	889
M-G 3.7 m.	"	"	175	-	350	122.5	919	306	0.3	276	92	350	1,195	398	1,169
D.T. 8t.	75	"	70	-	210	168.0	1,260	420	0.2	252	84	210	1,512	504	574
Agi.-T. 1.5m^3	"	"	56	-	196	105.0	788	263	"	158	53	196	946	316	455
W.T. 6,000ℓ	"	"	49	-	189	119.0	893	298	"	179	60	189	1,072	358	420
F.-T. 6t.	"	"	63	-	203	"	"	"	"	"	"	203	"	"	532
C.M. Plant 0.5m^3	60	-	154	50	264	-	-	-	-	-	-	264	-	-	1,344
C. mixer 0.3m^3	"	-	13	-	73	Δ11.5	69	23	0.1	7	2	73	76	25	122
C. vibrator 38m/m	-	-	2	50	55	o 5.6	50	17	"	5	2	55	55	19	39
Generator 61 KVA	60	-	25	-	85	Δ72.0	432	144	0.2	86	29	85	518	173	230
Rammer 80 Kg.	-	-	4	50	54	o 4.5	41	14	0.1	4	1	54	45	15	78
V.P. Comp. 70Kg.	-	-	3	"	53	o 4.5	41	"	"	4	1	53	45	"	64
Belt Comv. 7 m.	-	-	3	-	3	o 3.4	31	10	"	3	1	3	34	11	64
Pump 4"	-	-	15	-	15	Δ 5.8	35	12	"	4	1	15	39	13	90

Table A.4.8-7 Summary of Construction Cost on Civil Works

Description	Quantity	Amount (฿1,000) Foreign	Local	Total
1. Pumping station	1.0 place	10,682	20,477	31,159
2. Irrigation canal				
2.1 Canal	148 km	100,865	148,989	249,854
2.2 Structures	443 unit	12,965	52,101	65,066
Sub-total		113,830	201,090	314,920
3. Drainage canal				
3.1 Canal	22 km	26,484	11,956	38,440
3.2 Structures	18 unit	1,344	5,366	6,710
Sub-total		27,828	17,322	45,150
4. Demonstration farm	260 ha	1,211	2,689	3,900
5. Transmission line	5 km	-	3,620	3,620
Total		153,551	245,198	398,749

Table A.4.8-8 Procurement of Pumping Plant

Item and specification	Unit	Amount (฿1,000)
A. Foreign		
1. Mam pump, ø1,000 mm vertical, mixed flow	7 set	21,370
2. Electric Motor, 560KW	7 set	6,860
3. Operation board	L.S.	3,960
4. Transformer facilities, 5,000 KVA	L.S.	5,410
5. Butterfly valve, ø1,350 mm	7 set	2,800
6. Prevention valve, ø1,350 mm	7 set	700
7. Iron pipe, ø1,000, =24m	L.S.	7,420
8. Crane, 15 tons	L.S.	970
9. Sand pump set	L.S.	1,500
10. Miscellaneous and others	L.S.	1,475
Sub-total		52,465
B. Local		
1. Installation, transportation	L.S.	5,000
Sub-total		5,000
Total		57,465

Table A.4.8-9 Equipment and Vehicles for Project Implementation

Item	Quantity	Cost (฿ 1,000.-)
1. Foreign Currency portion		
* Station wagon 4 x 4	3	฿ 900.-
* Truck, pick-up 3/4 ton, 4 x 4	10	1,000.-
* Office equipment	L.S.	1,000.-
sub-total		฿ 2,900.-
2. Local Currency portion		
* Transportation	L.S.	50.-
* Others	"	50.-
sub-total		฿ 100.-
TOTAL		฿ 3,000.-

Table A.4.8-10 Equipment for Operation and Maintenance

Item	Quantity	Cost (฿ 1,000.-)
1 Foreign Currency portion		
* Backhoe, 0.35 cu.m.	1	฿ 1,100.-
* Tractor crawler, 140 HP.	1	1,400.-
* Grader, 110 HP.	1	1,050.-
* Loader, 1.60 m^3	1	1,270.-
* Dump truck, 6 ton	2	800.-
* Truck, pick-up 3/4 ton	8	800.-
* Concrete mixer 140 ℓ	2	60.-
* Pump, 100 mm.	5	150.-
* Station wagon	2	600.-
* Motor cycle 75 cc.	30	480.-
* Spare parts	L.S.	660.-
Total		฿ 8,100.-
2. Local Currency portion		
* Transportation	L.S.	฿ 300.-
* Delivery charges	L.S.	300.-
* Others	L.S.	300.-
Total		฿ 900.-
Grand total		฿ 9,000.-

Table A.4.8-11 Cost of Consulting Services and Training

(A) Consulting Services		
1. Foreign Currency Portion		
1-1. Remuneration (120 MM)		฿ 22,080,000
1-2. Out-of-pocket expenses		4,983,000
a. International travel expenses (27 R.T.)		(683,000)
b. Reimbursable cost item and others		(4,300,000)
1-3. Contingencies		2,737,000
Sub-total		฿ 29,800,000
2. Local Currency Portion		
2-1. Remuneration (110 MM)		฿ 5,500,000
2-2. Living allowance & quarter		2,000,000
2-3. Local communication transportation		500,000
2-4. Printing of reports		500,000
2-5. Contingencies		800,000
Sub-total		฿ 9,300,000
(B) Trainings		
1. Foreign Currency Portion		
1-1. International travel expenses (8 persons)		฿ 202,000
1-2. Per-diem ..... ฿1,150 x 4 persons x (60 days + 240 days)		1,380,000
1-3. Other cost		200,000
1-4. Contingencies		178,000
Sub-total		฿ 1,960,000
2. Local Currency Portion		
2-1. Preparation expenses		฿ 40,000
Sub-total		฿ 40,000
TOTAL — Foreign currency	฿ 31,760,000	
— Local currency	฿ 9,340,000	฿ 41,100,000

Table A.4.8-12 Comparison of Project Cost by Construction Method

(Unit: ฿1,000)

Description	Original			Alternative No.1			Alternative No.2		
	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total
1. Survey, Design	-	11,000	11,000	-	11,000	11,000	-	11,000	11,000
2. Civil works	153,551	245,198	398,749	105,579	221,912	327,491	134,922	234,166	369,088
3. Procurement	64,485	6,280	70,765	162,885	15,880	178,765	115,285	11,480	126,765
4. Land Acquisition	-	17,300	17,300	-	17,300	17,300	-	17,300	17,300
5. Project Facilities	-	5,000	5,000	-	5,000	5,000	-	5,000	5,000
6. Supporting Services	-	2,400	2,400	-	2,400	2,400	-	2,400	2,400
7. Administration	-	50,526	50,526	-	54,195	54,195	-	53,156	53,156
8. Consulting Services	31,760	9,340	41,100	31,760	9,340	41,100	31,760	9,340	41,100
Sub-total (1 - 8)	249,796	347,044	596,840	300,224	337,027	637,251	281,967	343,842	625,809
9. Physical Conting.	24,980	34,680	59,660	30,023	33,704	63,727	28,197	34,385	62,582
Total (1 - 9)	274,776	381,724	656,500	330,247	370,731	700,978	310,164	378,227	688,391
(Proportion)	(41.9%)	(58.1%)	(100%)	(47.1%)	(52.9%)	(100%)	(45.1%)	(54.9%)	(100%)
10. Price Escalation	98,570	180,730	279,300	94,038	166,888	260,926	99,612	174,807	274,419
Total (1 - 10)	373,346	562,454	935,800	424,285	537,619	961,904	409,776	553,034	962,810
(Proportion)	(39.9%)	(60.1%)	(100%)	(44.1%)	(55.9%)	(100%)	(42.6%)	(57.4%)	(100%)

Table A.4.8-13 Alternative of Project Year (5 Years)

Description	1982			1983			1984			1985			1986			Total		
	F.C.	L.C.	T.	F.C.	L.C.	T.	F.C.	L.C.	T.	F.C.	L.C.	T.	F.C.	L.C.	T.	F.C.	L.C.	T.
1. Survey Design	-	2,500	2,500	-	3,500	3,500	-	3,000	3,000	-	1,500	1,500	-	500	500	-	11,000	11,000
2. Civil Works																		
2.1 Pumping Station	-	-	-	-	-	-	6,856	13,143	19,999	3,826	7,334	11,160	-	-	-	10,682	20,477	31,159
2.2 Irrigation Canal	-	-	-	-	-	-	27,236	40,939	68,175	43,036	63,748	106,784	30,593	44,302	74,895	100,865	148,989	249,854
2.3 Irri. Structures	-	-	-	-	-	-	3,432	13,791	17,223	5,536	22,247	27,783	3,997	16,063	20,060	12,965	52,101	65,066
2.4 Drainage Canal	-	-	-	-	-	-	-	-	-	14,111	6,371	20,482	12,373	5,585	17,958	26,484	11,956	38,440
2.5 Dran. Structures	-	-	-	-	-	-	-	-	-	807	3,219	4,026	537	2,147	2,684	1,344	5,366	6,710
2.6 Demonstration Farm	-	-	-	-	-	-	-	-	-	1,211	2,689	3,900	-	-	-	1,211	2,689	3,900
2.7 Transmission Line	-	-	-	-	-	-	-	-	-	-	3,620	3,620	-	-	-	-	3,620	3,620
Sub-total	-	-	-	-	-	-	37,524	67,873	105,397	68,527	109,228	177,755	47,500	68,097	115,597	153,551	245,198	398,749
3. Procurement																		
3.1 Pump Plants	-	-	-	-	-	-	52,465	-	52,465	-	5,000	5,000	-	-	-	52,465	5,000	57,465
3.2 Gates	-	-	-	-	-	-	-	-	-	1,020	-	1,020	-	280	280	1,020	280	1,800
3.3 Project Equipment	-	-	-	-	-	-	2,900	100	3,000	-	-	-	-	-	-	2,900	100	3,000
3.4 O.M.Equipment	-	-	-	-	-	-	-	-	-	-	-	-	8,100	900	9,000	8,100	900	9,000
Sub-total	-	-	-	-	-	-	55,365	100	55,465	1,020	5,000	6,020	8,100	1,180	9,280	64,485	6,280	70,765
4. Land Aquisition	-	-	-	-	3,770	3,770	-	7,580	7,580	-	5,950	5,950	-	-	-	-	17,300	17,300
5. Project Facilities	-	1,000	1,000	-	4,000	4,000	-	-	-	-	-	-	-	-	-	-	5,000	5,000
6. Supporting Services	-	-	-	-	400	400	-	800	800	-	600	600	-	600	600	-	2,400	2,400
7. Administration	-	350	350	-	1,167	1,167	-	17,224	17,224	-	19,183	19,183	-	12,598	12,598	-	50,522	50,522
8. Consulting Services	-	-	-	8,380	2,800	11,180	8,430	2,520	10,950	7,690	2,270	9,960	3,460	1,180	4,640	27,960	8,770	36,730
Total (1 - 8)	-	3,850	3,850	8,380	15,637	24,017	101,319	99,097	200,416	77,237	143,736	220,968	59,060	84,155	143,215	245,996	346,470	592,466
9. Physical Contingency	-	385	385	838	1,564	2,402	18,132	9,910	20,042	7,724	14,373	22,097	5,906	8,416	14,322	24.600	34,647	59,247
Total (1 - 9)	-	4,235	4,235	9,218	17,201	26,419	111,451	109,007	220,458	84,961	158,104	243,065	64,966	92,571	157,537	270,596	381,117	651,713
10. Price Escalation	-	356	356	1,438	3,010	4,448	25,968	29,868	55,836	26,593	60,238	86,831	25,727	46,008	71,735	79,726	139,480	219,206
Grand Total (1 - 10)	-	4,591	4,591	10,656	20,211	30,867	137,419	138,875	276,294	111,554	218,342	329,896	90,693	138,579	229,272	350,322	520,597	870,919

Fig. A.4.8-1 Construction Plan of Irrigation Canal

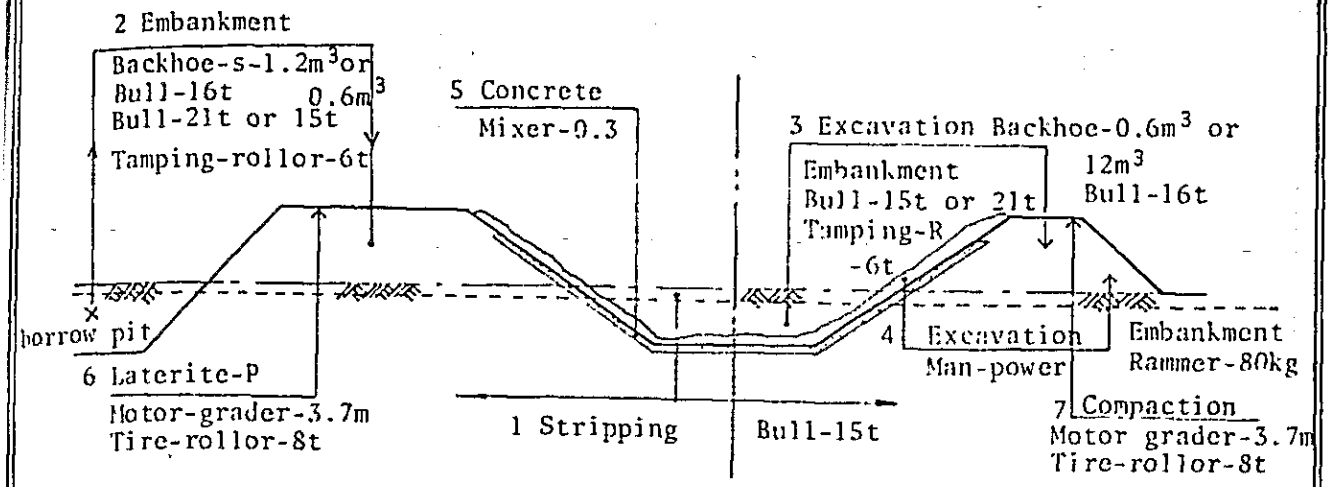

Fig. A.4.8-2 Construction Plan of Pumping Station