

**MY EXPERIENCES**  
**WITH**  
**LAND CONSOLIDATION and WATER MANAGEMENT**  
**in**  
**THAILAND**

**JUNICHIRO NAKAJIMA**

**TEAM LEADER**

**MARCH 1985**

**THAI IRRIGATED AGRICULTURE DEVELOPMENT PROJECT**  
**PROJECT CENTER**

**JAPAN INTERNATIONAL COOPERATION AGENCY**

ADT
JR
85-70



**MY EXPERIENCES**  
**WITH**  
**LAND CONSOLIDATION and WATER MANAGEMENT**  
**in**  
**THAILAND**

**JUNICHIRO NAKAJIMA**

**TEAM LEADER**

**MARCH 1985**

**THAI IRRIGATED AGRICULTURE DEVELOPMENT PROJECT**  
**PROJECT CENTER**

**JICA LIBRARY**



**1050497[5]**

**JAPAN INTERNATIONAL COOPERATION AGENCY**

国際協力事業団

受入 月日 '85.12.12	122
登録No. 12203	893
	ADT

### Acknowledgements

This report was codified from the author's actual experience in this field for more than five years in Thailand. The author engaged in the Thai Irrigated Agriculture Development Project from September, 1979 to March, 1985. The project was a technical cooperation project based on land consolidation between Thailand and Japan. During my service period, I made efforts to collect the data concerned to my utmost ability.

At times, I, myself, stayed at the MaeKlong Pilot Project site for three months to make a survey concerning this matter. At times, I visited other projects such as the ChaoPhya stage 2 project, the Nongwai Project, the Pitsanulok Project, the Nam Oon Project and so on, and at times, I exchanged views with the Thai officials concerned. It might be said that land consolidation in Thailand is still in its formative years in spite of its long history. Many problems still remain to be solved including development methods, improvement of on-farm water management and future projects of farming mechanization. I wish you success in this field.

On the occasion of making this report, I would like to express my sincere thanks to the following people who gave me kind advice and much cooperation:

Mr.Paitoon Palayasoot : Inspector General, MOAC.

Mr.Nukool Thongtawee : Director of O&M Division, RID.

Mr.Roongrueng Chulajata : Project Manager of MaeKlong Irrigation Project,  
RID.

Mr.Nawarat Pomthong : Chief of On-Farm Design Section, Design Division,  
RID.

Mr.Chalermthep Ratanaprayon : Agronomist, Irrigated Agriculture Branch,  
O&M Division, RID.

Mr.Metha Howarangkul : Irrigation Engineer, O&M Division, RID.

Mr.Bunyong Piyasirinon: Civil Engineer, O&M Division, RID.

Mr.Direk Thongareram : Agronomist, Irrigated Agriculture Branch, O&M  
Division, RID.

Mr.Poonsin Leknamee : Director General, CLCO, MOAC.

Mr.Prateep Soampong : Section Chief, CLCO, MOAC.

Mr.Kovit Thuamsangiem : Irrigation Engineer, CLCO, MOAC.

Mr.Chaiyut Pruengwet : Civil Engineer, CLCO, MOAC.

Mr.Tanasit Aungrasit : Translator, Thai Central Chemical Company.



## Contents

	Page
Chapter I Maps	1
A. Whole Kingdom of Thailand	2
B. Regional Maps of Thailand	3
1. North-East Region	3
2. North Region	4
3. Central Region	5
4. South Region	6
Chapter II Pictures	7
A. Seasonal View of the West Bank Tract of the Chao Phya River	8
B. Water Hyacinth (Nuisance of Irrigation System)	9
C. The Typical Facilities for Irrigation in Thailand	10
Chapter III Brief Introduction of Present State of the Thai Agriculture	25
A. General Matters	26
1. Geographical Location	26
2. Area of Her Territory	26
3. Classification of Agricultural Land	26
4. Climate	26
5. Population	28
B. Present State of the Thai Agriculture	29
1. Distribution of Agricultural Land by Region	29
2. Paddy Land and Planted Area Annually	30
3. Annual Production of Rice	31
4. Yield per 10 a	31
5. Yield per Rai (Kgs) by Region	32
6. Typical Rice Cropping Season	33

7.	Agricultural Income per Household	33
8.	Number of Farmers and Average Agricultural Farmhouse	34
9.	Retail Price of rice	34
10.	Producers' Price of Rice	34
11.	Countries Where Thai Rice is Exported	35
12.	Production and Export of the Main Agricultural Production	36
13.	Farm Equipment	36
Chapter IV Brief Introduction of Irrigation Development in Thailand		37
A.	Present State of Irrigation Development by RID	38
1.	Small-Scale Irrigation Program	38
2.	Medium-Scale Irrigation Projects	39
3.	Large-Scale Irrigation Projects	39
3.1	Phitsanulok Irrigation Project	39
3.2	Ground Water Development Project for Irrigation	40
3.3	Mae Ngat Project	40
3.4	Mae Kuang Project	40
3.5	Mae Klong Yai Project	40
3.6	Bang Barn Project	40
3.7	Dom Noi Project	41
3.8	Huay Luang Project	41
3.9	Pattani Project	41
3.10	Munoh Project	41
3.11	Bang Wad Project	41
3.12	Upper Moon River Project	41
3.13	Nong Koh Project	42
3.14	Water Pipe Laying Project at Dokkrai-Mab Ta Pud	42



4.	Financial Support from ADB	43
5.	Financial Support from the World Bank	44
6.	Financial Support from KFW	44
7.	Financial Support from OECF	45
8.	Financial Support from USAID	46
9.	Other Projects Supported by Overseas Financial Sources	47
B.	Brief Introduction of Irrigation Development in Thailand	48
1.	Water Resources Development Completed to the End of 1982	48
2.	Accumulated Irrigated Area Completed to the End of 1982 by Region	48
3.	Water Resources Development in Thailand by Region Completed to the End of 1981 and Under Construction	49
4.	Irrigation Development Annually	49
5.	Dams in Thailand	50
Chapter V	On-farm Development Projects	53
A.	On-farm Development Projects	54
B.	The background of Land Consolidation in Thailand	57
C.	Dikes and Ditches Projects	59
1.	Constructed Dikes and Ditches Projects	61
D.	Land Consolidation in Thailand	64
1.	Introduction	64
2.	Definition of Land Consolidation	64
3.	History of Land Consolidation in Thailand	65
4.	Prospects of Land Consolidation in Thailand	66
5.	Legislation and Organization	66
6.	Objects of Land Consolidation in Thailand	67
7.	Implemented Land Consolidation Area	68
8.	Construction Costs per Rai Annually	72

9.	The Land Consolidation Procedure	79
9.1	By the Agricultural Land Consolidation Act	79
9.2	Detailed Implementation Process	80
10.	Intensive and Extensive Land Consolidation Compared	83
E.	Operation and Maintenance Fees (O&M fees) in Completed Land Consolidation Areas	87
1.	Kind of Expense	87
2.	Efficiency per Unit Work of O&M Work	87
3.	Density of Irrigation Ditches, Drainage Ditches and Other Facilities	88
4.	Table of Efficiency per Unit Work	89
5.	O&M Fees (Man/Rai)	90
F.	Repayment of the Project Cost of Land Consolidation	91
1.	The Result of the Study on Means of Repayment of the Land Consolidation Project	91
2.	How to collect Amortisation at the ChaoPhya Land Consolidation Project Stage-2, the Phitsanulok Project and the Nong Wai Project	93
G.	Farmers' Land Consolidation Project financed by the Bank for Agriculture and Agriculture Cooperatives (BAAC)	99
1.	Preface	99
2.	Working Procedures	99
3.	The Obligation of Agencies Concerned	100
4.	Credit for Land Consolidation	101
5.	Activities for Construction Work	102
6.	Direct Advantages which the Farmers who join in the Project will get	104
H.	Study Matters on Land Consolidation in Thailand	105
1.	Preface	105
2.	To Study the Implementation Method of Land Consolidation in Thailand	106
2.1	Project Cost and Benefit Evaluation	107

2.2	A View of Future Prospects of Mechanized Farming and Agricultural Population	108
2.3	To Export Various Farming Productions	108
3.	Detailed Technical Matters	108
3.1	Study on the Size of a Field Block, a Farm Block and a Unit Field Block	108
3.2	Irrigation Requirement	120
3.3	Size of Service Unit and Rotation Block	126
3.4	Boundary (Border)	127
3.5	Problems as to Irrigation Ditch	130
3.6	Design Matters	146
3.7	Culvert	155
3.8	Small Concrete Structure	156
3.9	Drainage Ditch	157
4.	Standardization of Design Criteria	161
I.	Guidelines for Design of On-farm Works for ChaoPhya Irrigated Agriculture Development Project	162
1.	Design Criteria	162
1.1	Irrigation Ditches	162
1.2	Drains	165
1.3	Farm Roads	168
2.	Design of Irrigation Ditches and Farm Roads	169
3.	Design of Structure	179
3.1	Culverts	179
3.2	Constant Head Orifices	180
3.3	Check Structures	180
3.4	Drop Structures	182
3.5	Division Boxes	182
4.	Design of Drains	183
J.	Standard in On-farm Irrigation System Design for Paddy Fields	185

1. Preface	185
2. Design Steps	185
3. Paddy Field Development Levels	185
4. Calculation for the Size of Ditches/Design Ditch Discharge	186
5. Structure and Cross Section Area of the Ditch	192
6. Longitudinal Slope	193
7. Constructions	194
8. Drainage System	194
9. Conveyance Efficiency	194
10. Practicing	198
Chapter VI Farm Water Management	207
A. General Statement on Water Management	208
B. The Government Organization in Charge of Water Management	210
1. Headquarters of Royal Irrigation Department	210
2. Regional Office of Royal Irrigation Department	211
3. General Organization of Water Management in Thailand	212
C. The Problems with which Water Management in Thailand are confronted.	213
D. Water Master and Zonemen, Job Description	215
1. The Water Master	215
2. The Zonemen	215
E. An Example of Water Management Organization established in the MaeKlong Right Bank Land Consolidation Area	218
F. Effectiveness of Water Management	219
1. Standard of Making the Charts	219
2. How to use the Charts	220

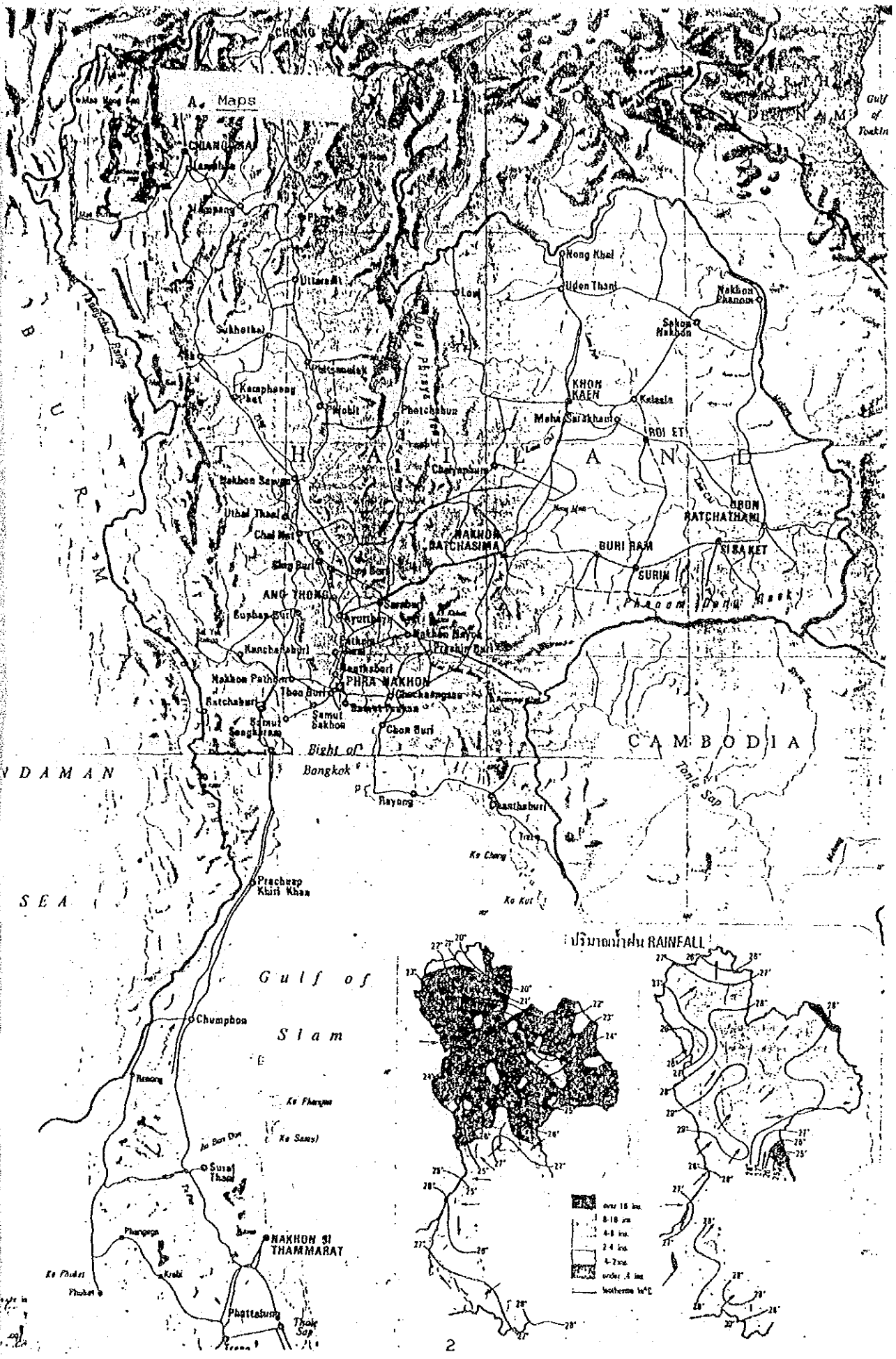
H.	Some Actual Examples of Water Management Scheme	225
	1. From the Nong Wai Pioneer Agriculture Project	225
	2. From the MaeKlong Irrigation Project	235
I.	Rice Cultivation Methods and Water Management Techniques	238
	1. Water Management Techniques should be developed on the Basis of the Direct Sowing Method	238
	2. Water Management based on the Direct Sowing in Flooded Paddy Field and Transplanting	239
	3. Advisable Rice Planting Method from the Viewpoint of Farm Water Management	243
	4. Amount of Rainfall	246
	5. Summary	247
J.	Fundamental Survey for Water Management	249
	1. Preface	249
	2. Readjustment Works (Rehabilitation)	251
	3. Collection of Data from the field to excute Good Water Management	251
	4. Investigation Irrigation at the Farm Level	253
K.	Computation Formulas of the Peak Water Requirement for Paddy	253
	1. General Principles	308
	2. Conventional Formula	309
	3. Improved Formula	315
	4. Summary and Suggestion	316
L.	Potential Evapotranspiration and Crop Coefficient for Rice in Thailand	324
	1. Preface	324
	2. What is the Consumptive Use or Evapotranspiration ?	324
	3. Measurement of Consumptive Use or Evapotranspiration	324

4.	Studying Trends	324
5.	What is Potential Evapotranspiration ?	325
6.	The Purposes of this Study	325
7.	Summary on the Study of Each Method	325
8.	The Uses of the Studied Methods	326
9.	Summary of Estimation of Rice Coefficient	327
10.	Suggestion of Crop Coefficient of RD rice Varieties	328
11.	Summary on Water Requirement for Rice by the Use of Lysimeter and the Usages	329
12.	Summary and Suggestion	329
13.	Users Summary	330
14.	Monthly Potential Evapotranspiration (mm/month)	331
15.	Daily Potential Evapotranspiration (mm/day)	334
16.	Potential Evapotranspiration Elevation (mm/month)	337
17.	Potential Evapotranspiration in Each Area (mm/day)	350
Chapter VII	Stipulation for On-Farm Development and Agricultural Land consolidation Act	371
1.	Summary of Stipulation for On-Farm Development	372
2.	Agricultural Land Consolidation Act	375 - 394

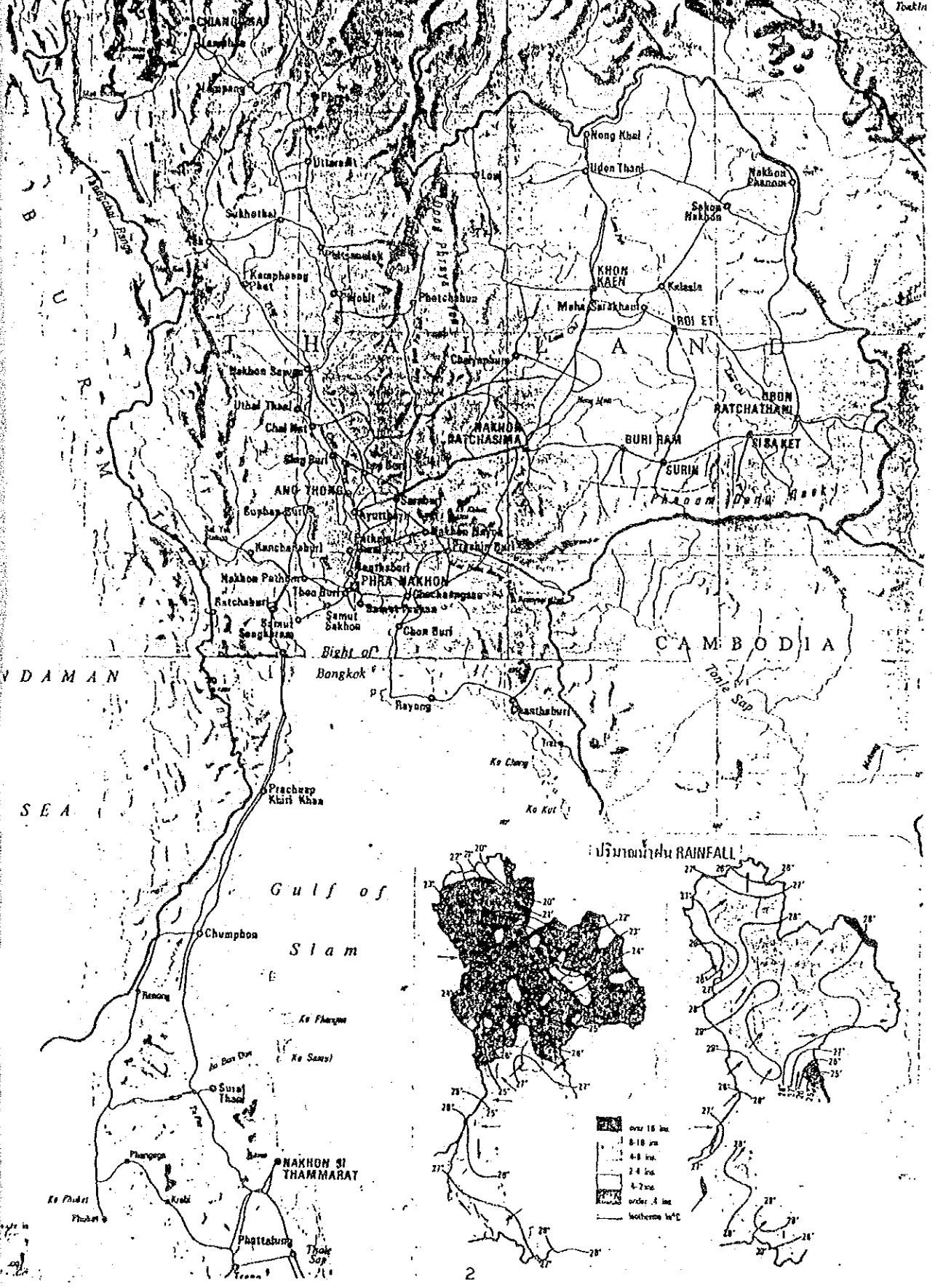
## CHAPTER I. MAPS







**A. Maps**



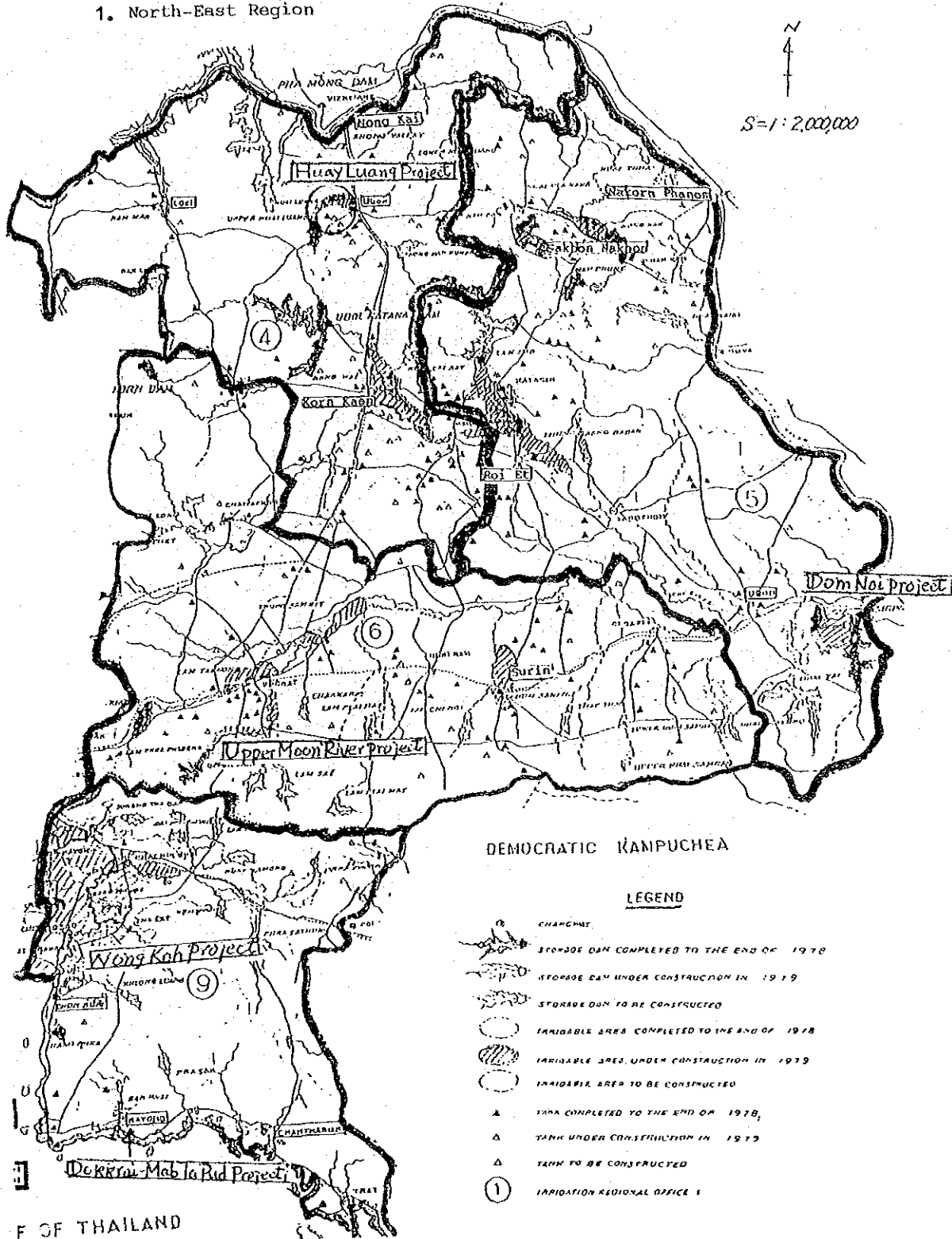


B. Regional map of Thailand

showed Administrative zones of RID's Regional Offices  
and Location of Large Scale Irrigation Projects

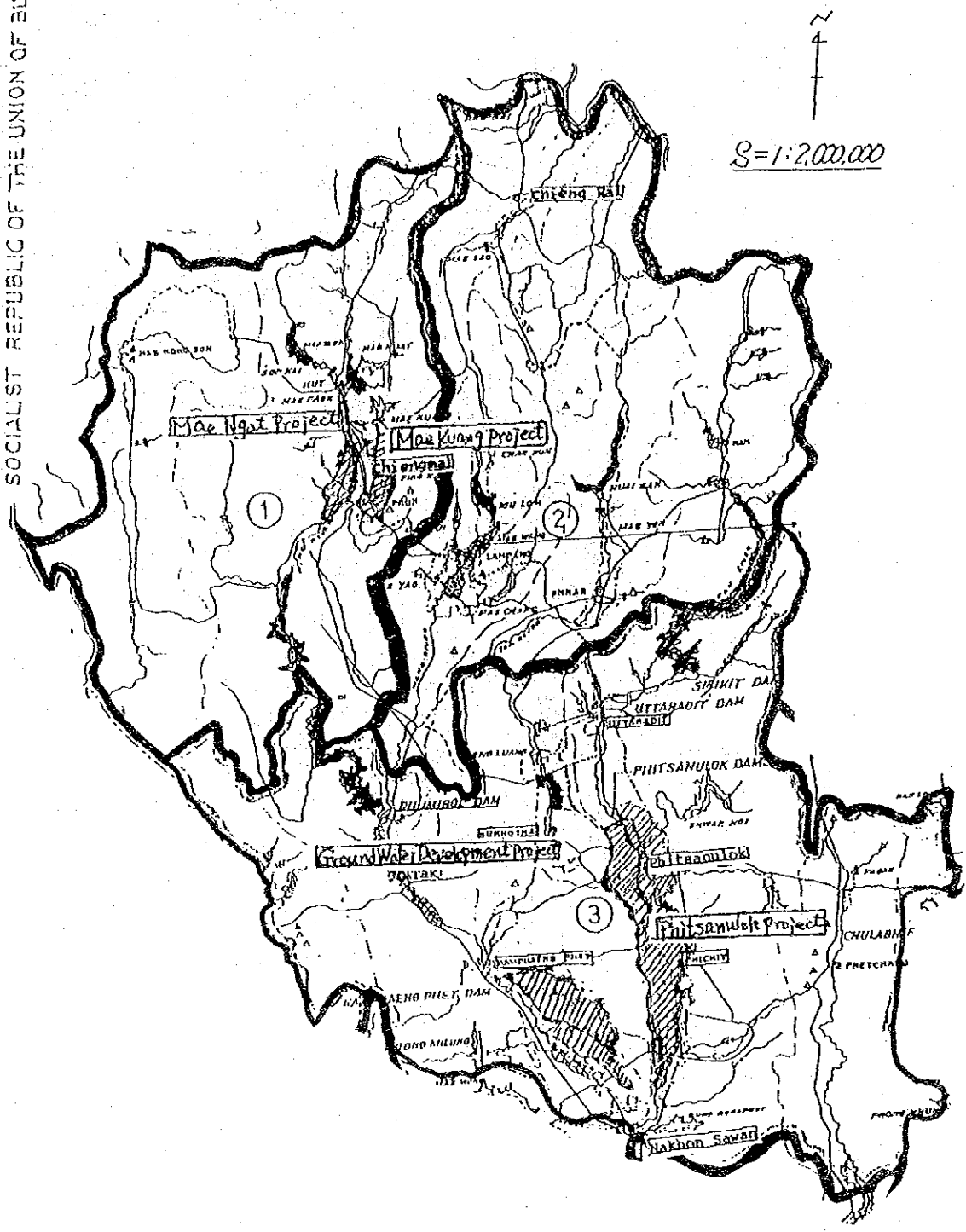
1. North-East Region

DEMOCRATIC PEOPLE'S REPUBLIC OF LAOS





2. North Region







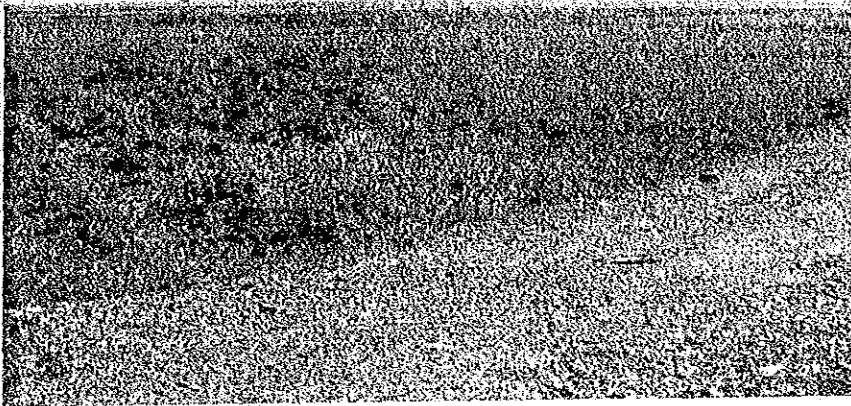




## CHAPTER II. PICTURES



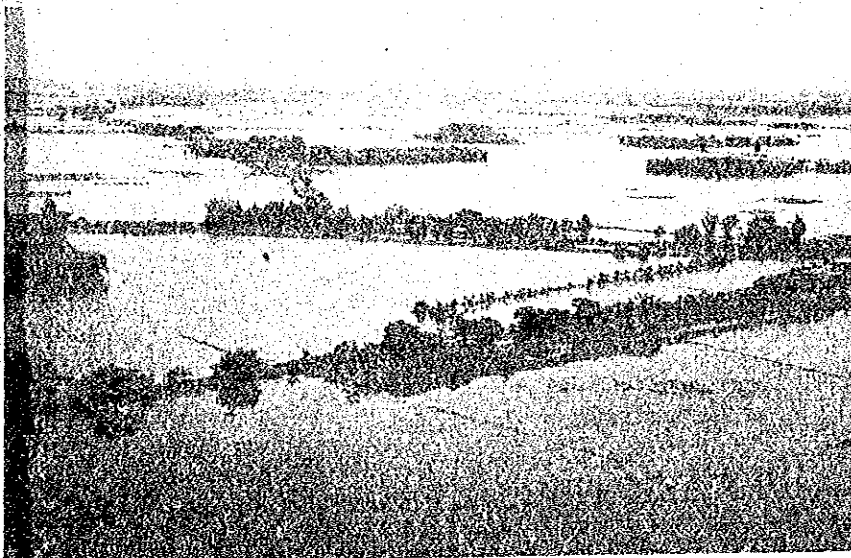
A. Seasonal view of the West Bank tract of the ChaoPhya River



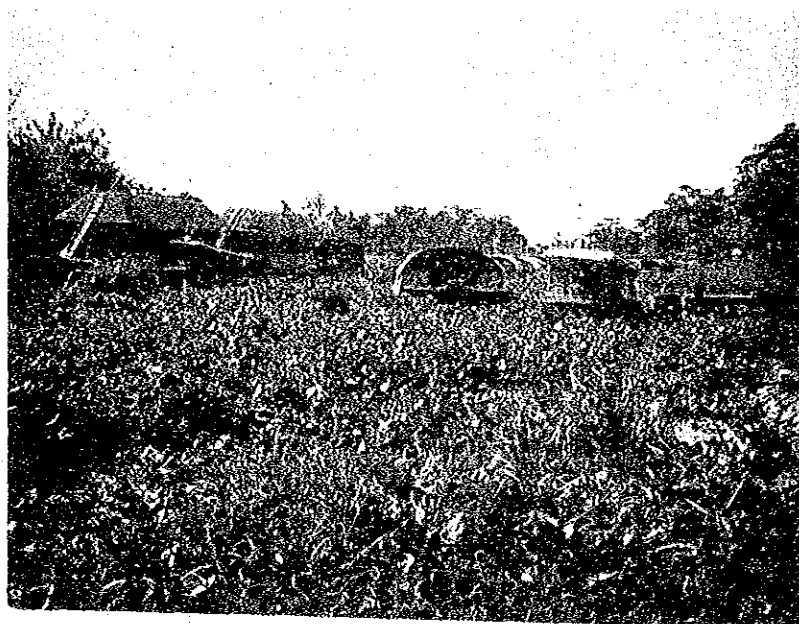
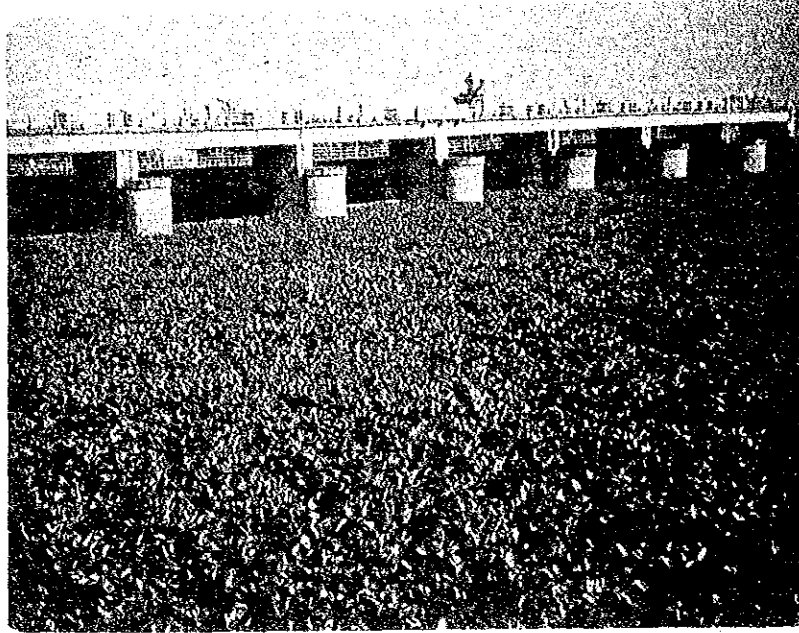
Dry season



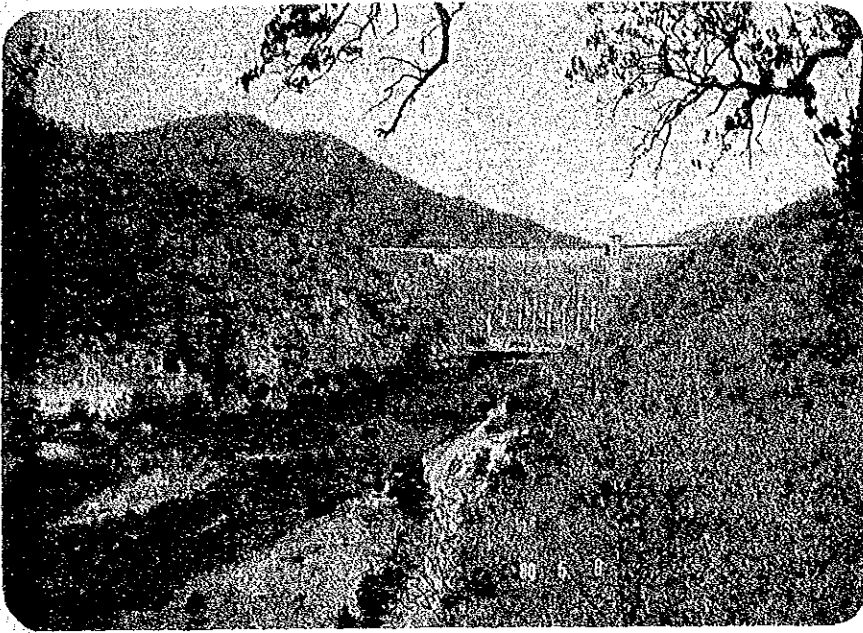
Rainy season



B. Water hyacinth (nuisance of irrigation system)

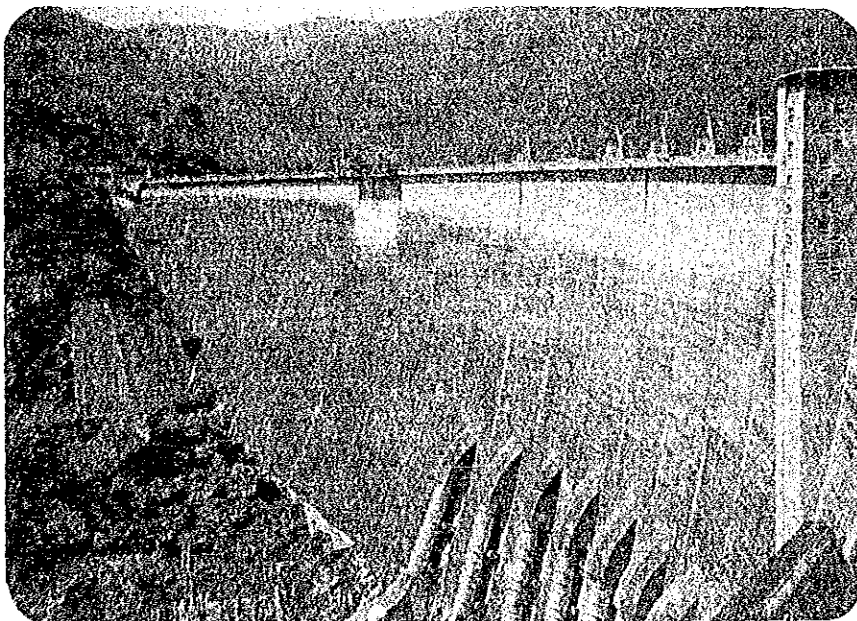
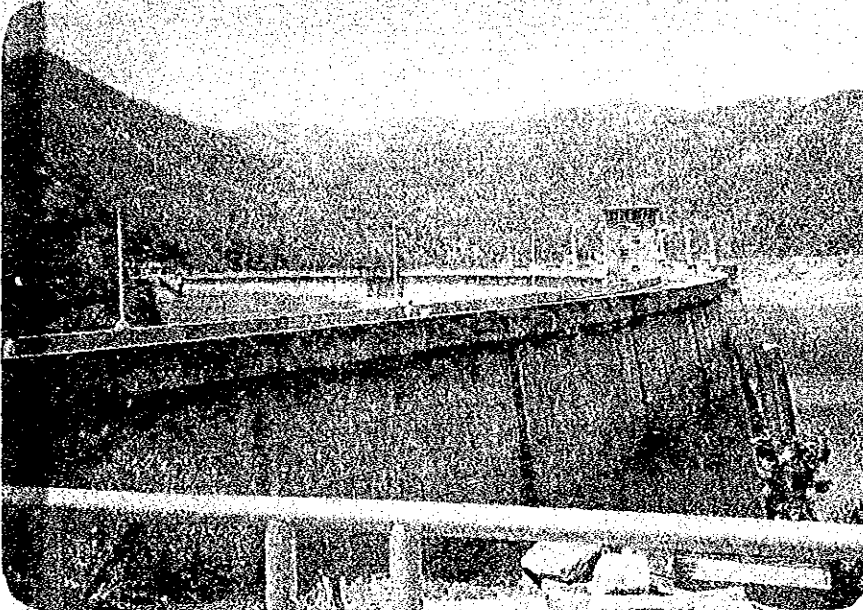


C. The typical facilities for irrigation in Thailand

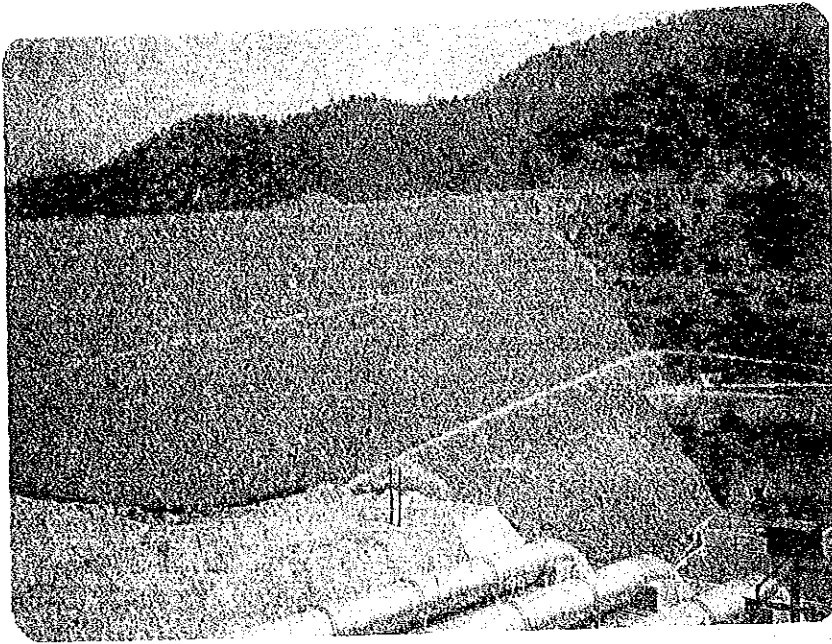


Bhumibhal Dam

- : Purpose
  - Irrigation
  - Hydro Electric power
  - Flood control
- : Concrete arch Dam
- : Height 154 m
- : Crest length 486 m
- : Volume of dam 970,000 m<sup>2</sup>
- : Catchment area 26,386 Km<sup>2</sup>
- : Gross capacity of reservoir 13,464 MCM
- : Effective capacity of reservoir 8,600 MCM
- : River-Ping



### Srinagarind Dam



Purpose: I,F,P

Type : Rock fill dam

Height: 140 m

Crest length : 610 m

Volume of Dam : 12,300,000 m<sup>3</sup>

Catchment area: 10,880 Km<sup>2</sup>

Gross capacity of reservoir

17,745 MCM

Effective capacity of

reservoir 7,470 MCM

River : Quae Yai

### Ubolratana Dam

Type : Rock fill dam

Height : 32 m

Crest length : 800 m

Dam volume : 515,000 m<sup>3</sup>

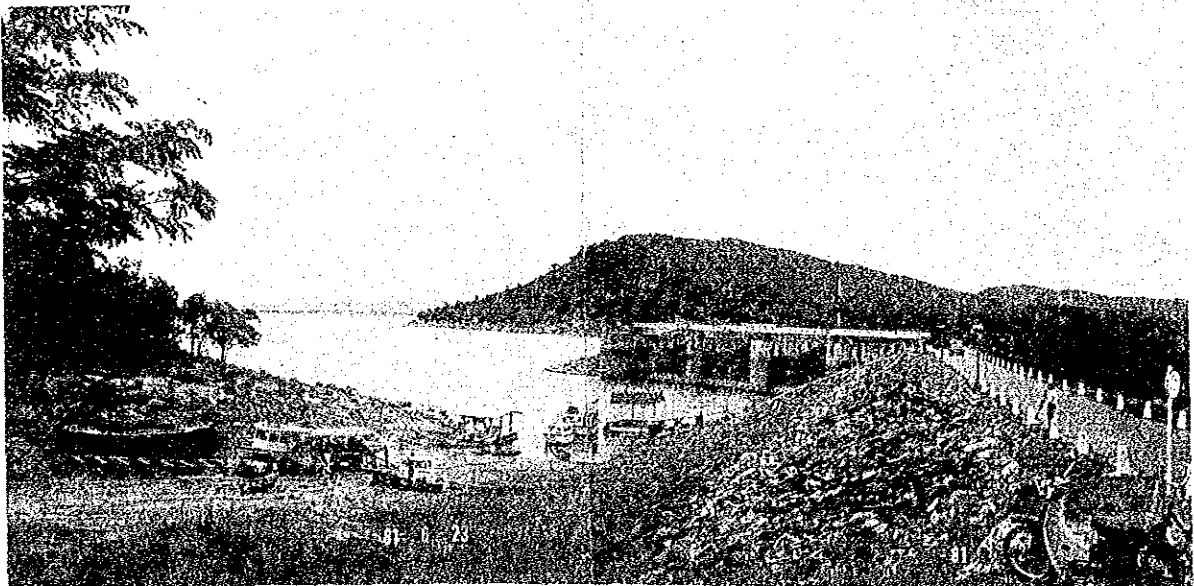
Catchment area : 12,000 Km<sup>2</sup>

Storage capacity : 1,550 MCM

Effective storage capacity

: 1,900 MCM

River : Nam pon



ii) Head works

Vajiralongkorn diversion dam

Height : 14 m

Width : 117.5 m

Nos of gate : 8

Span of a gate : 12.5 m

: Navigation lock

Height : 14 m

Length : 217 m

Max. lift : 9 m .

: Intake

Height : 8.8 m

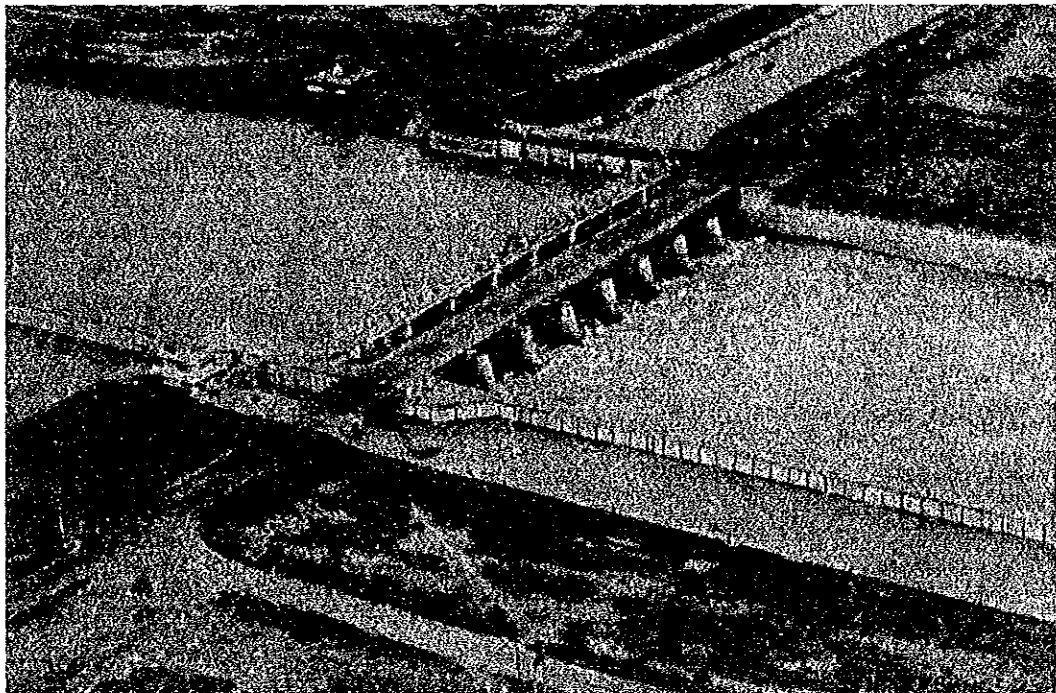
Width : 41 m

Nos of gate : 6

Span of gate : 6 m

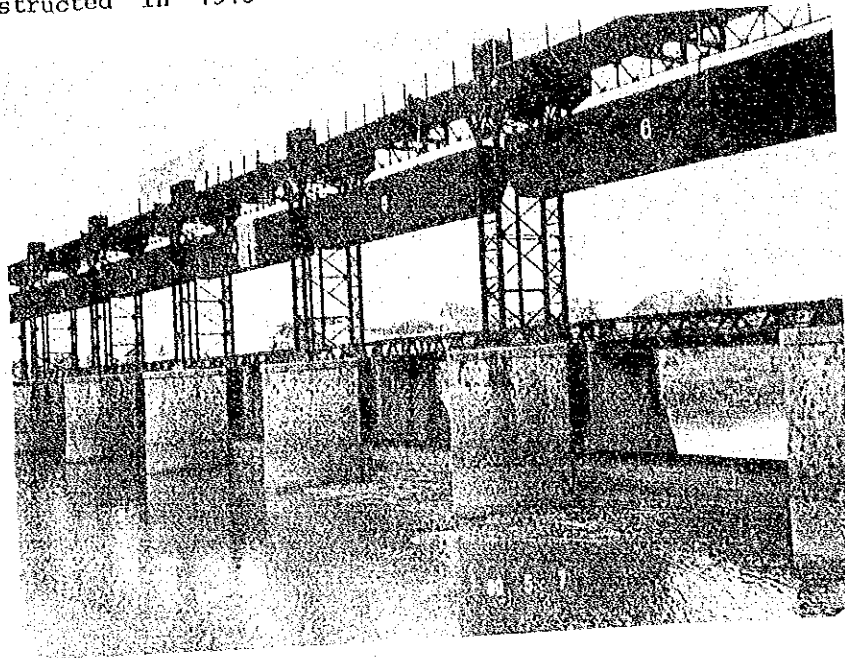
Construction period : 1964-1975

River : Mae Klong river



Rama VI Barrage

Constructed in 1915



Phitsanulok Diversion works

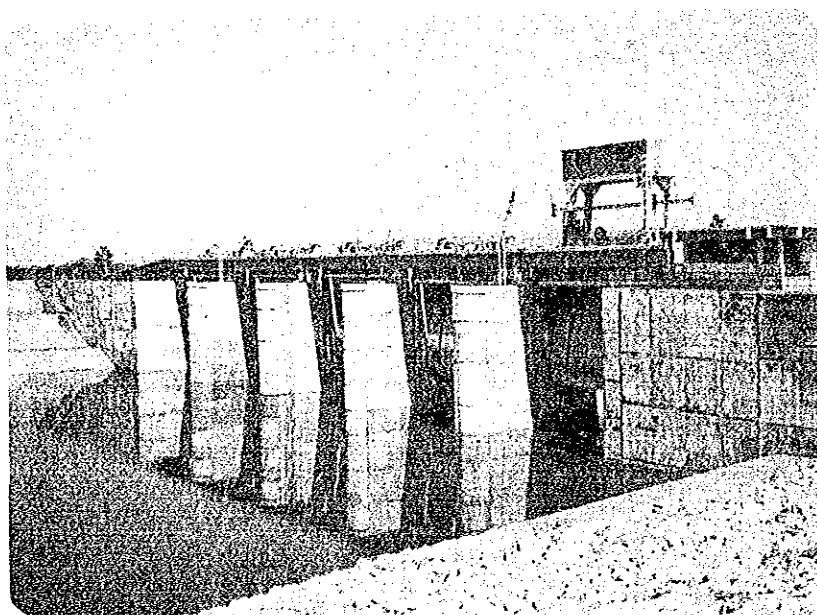
Height : 22.5 m

Length : 147.5 m

Type : Floating type

Gate : 5 units 12.5m x 7.5 m

Construction period : 1978-1980



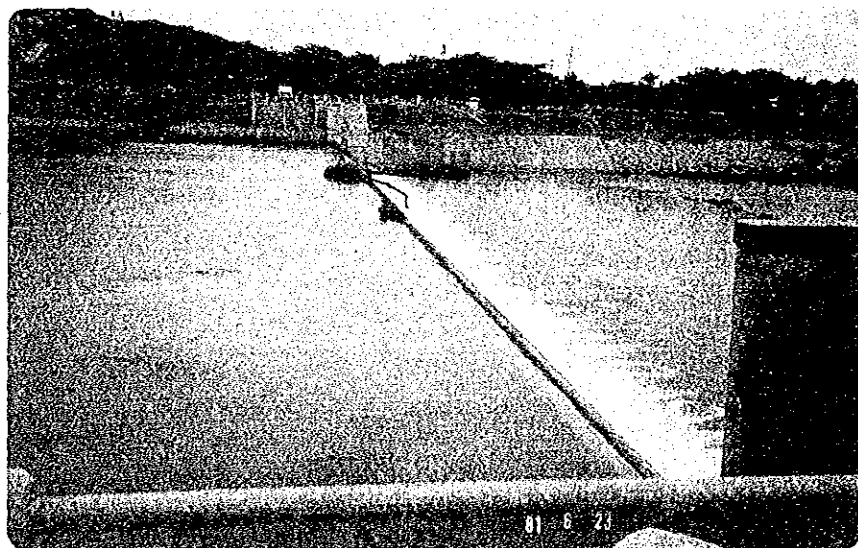
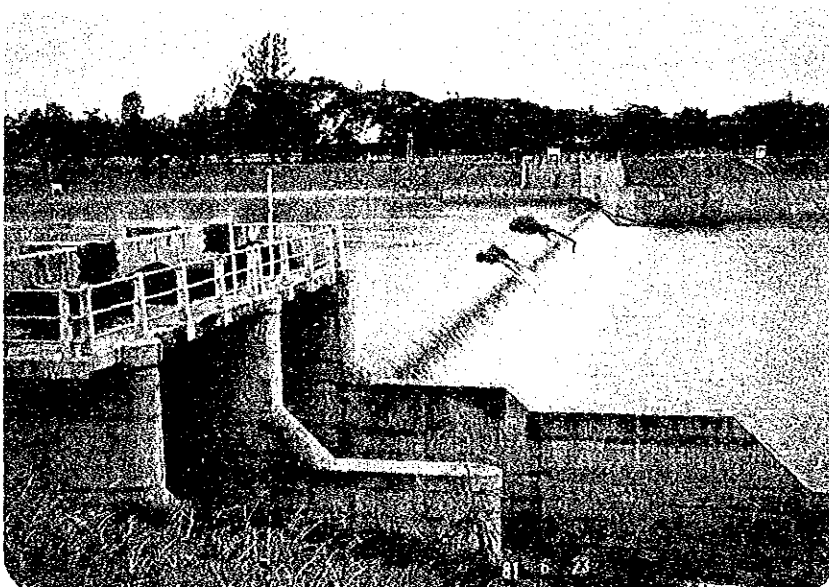
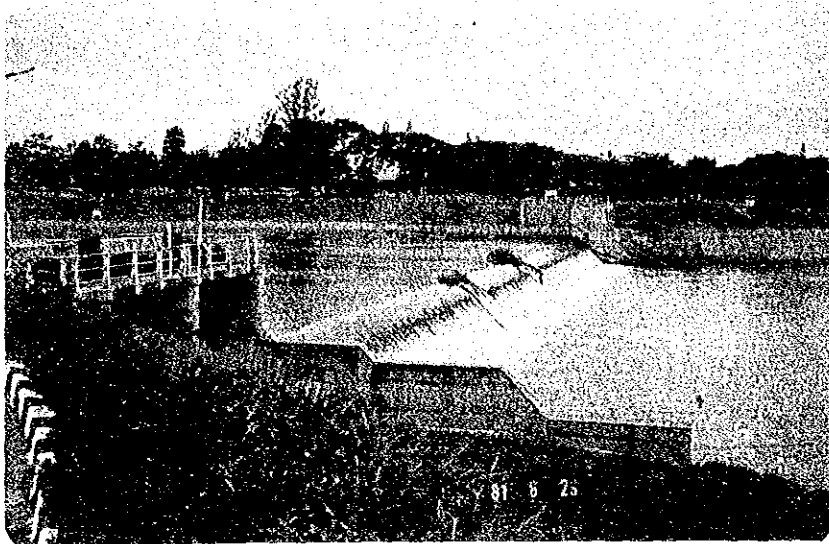


Nam Pong Project

Type : Ogie weir

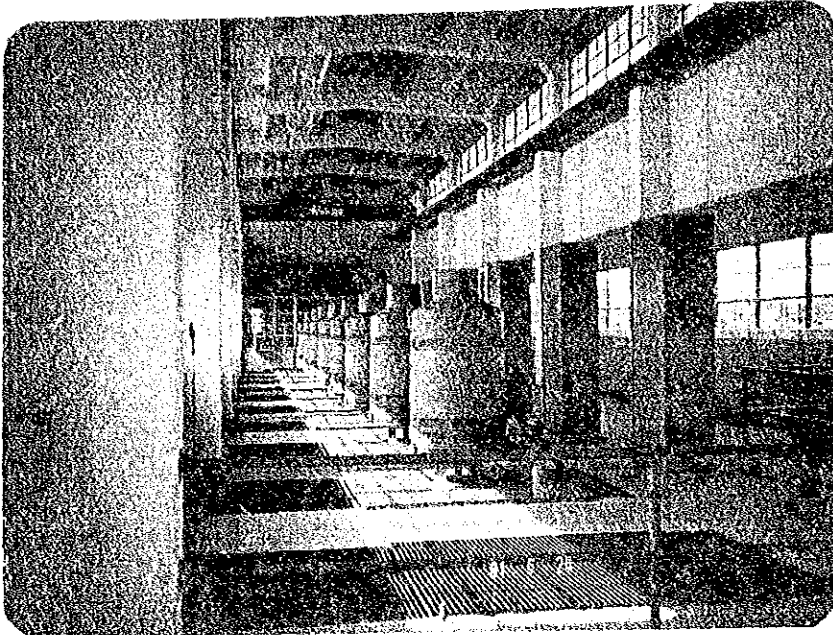
Crest length : 125 m

Height : 5.9 m



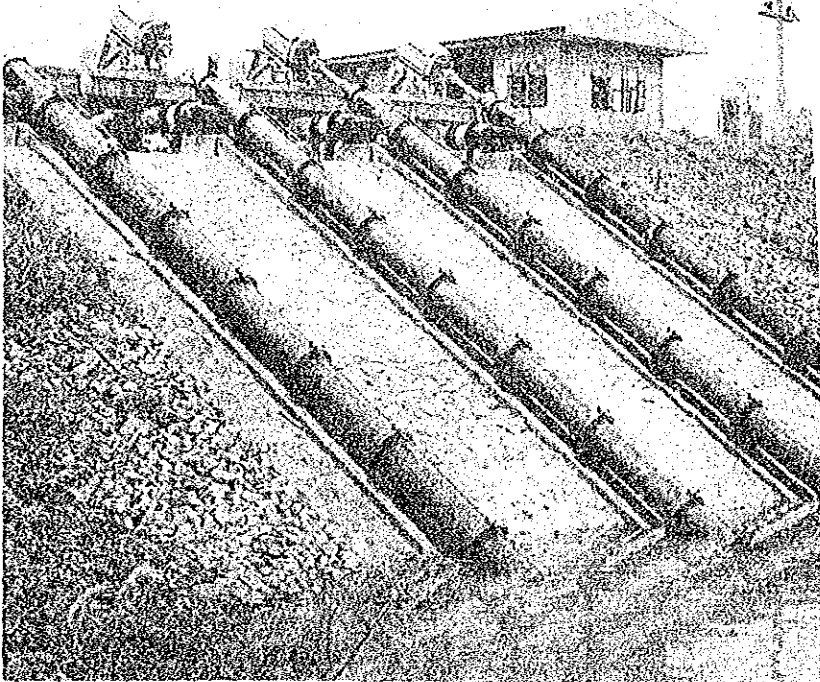
iii) Pumping stations

Dom noi Project

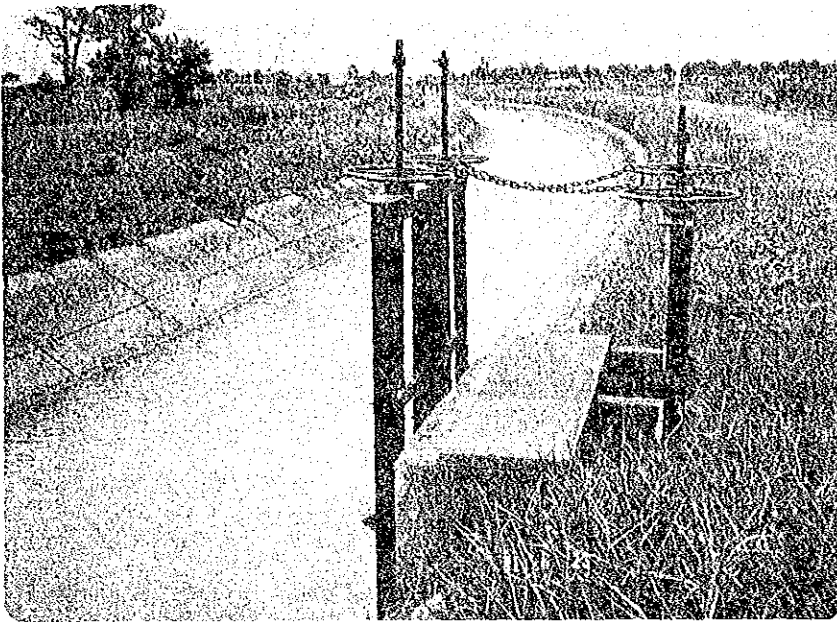


Namoon Pump Station,  
Royal Irrigation Department,  
Thailand

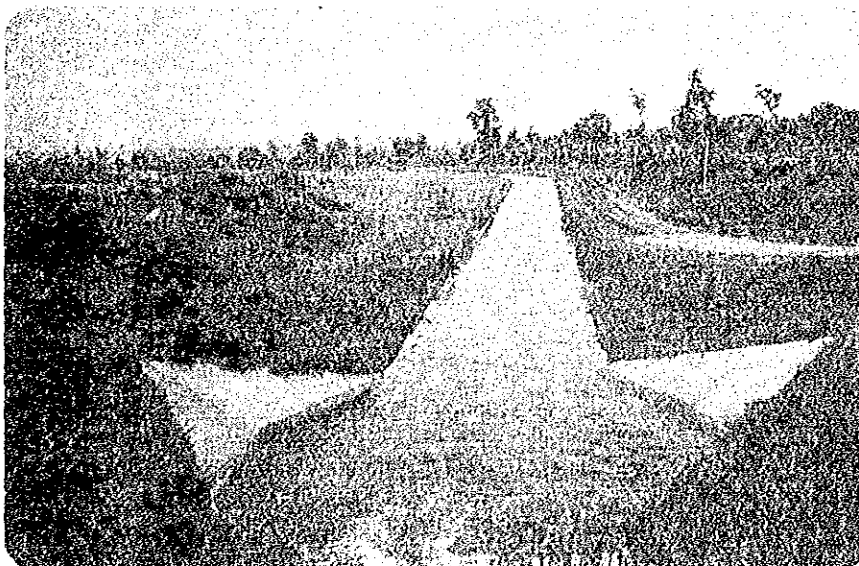
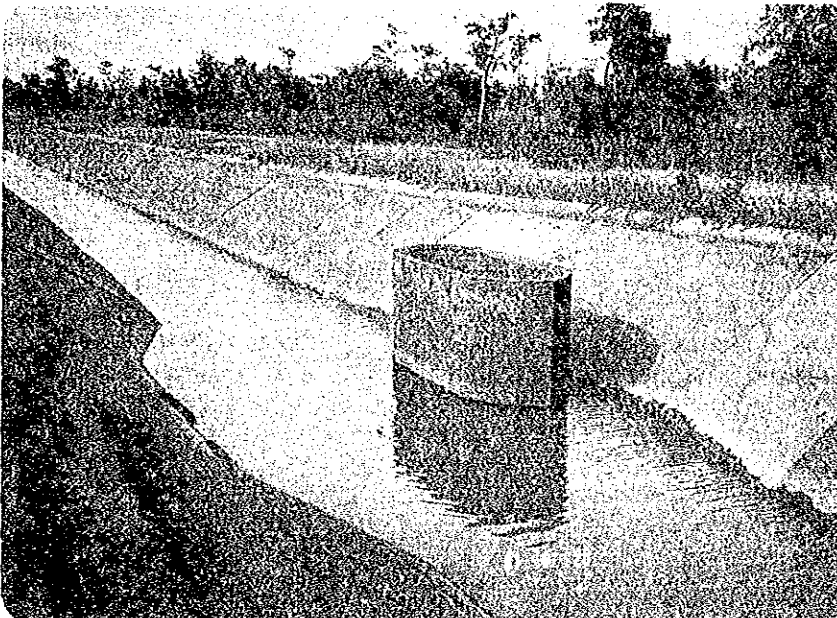
Model : DFS  
Bore : 500mm  
Capacity : 36m<sup>3</sup>/min  
Total Head : 35.5m  
Prime Mover : 260kw



iv) Canals



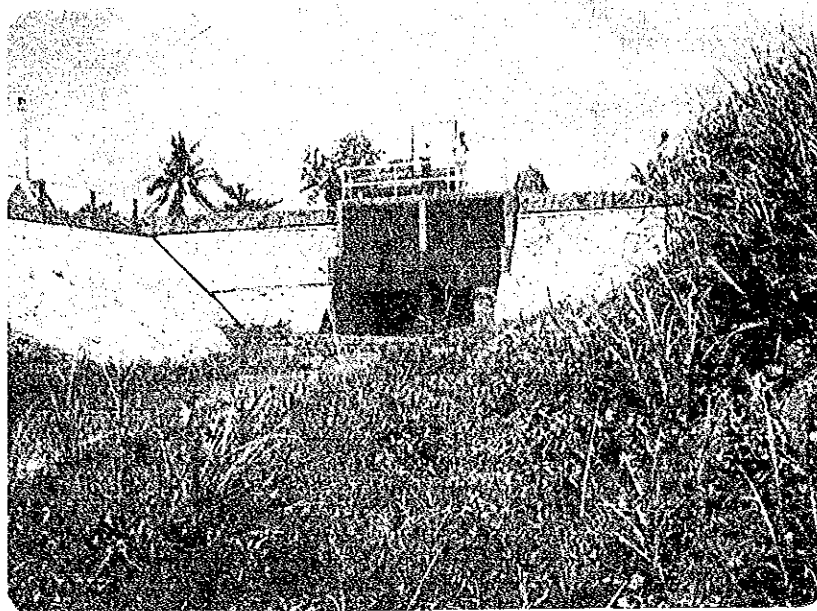
Double orifice inlet



v) Small Scale Irrigation Projects

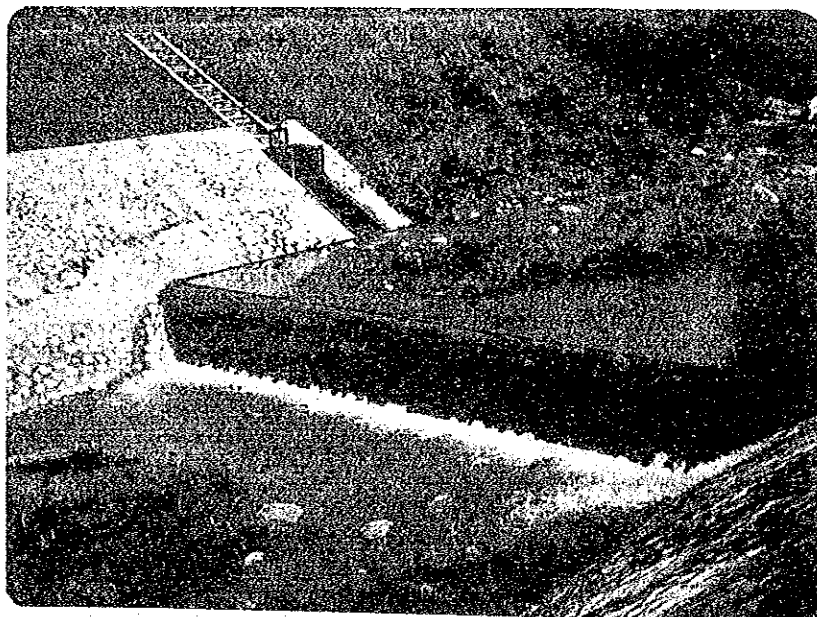
1. Kolng Ta Wet Regulator

For intake of water from Yom River for irrigation of 800 ha of paddy field in dry season. Construction cost 11.1 million Yen (1983).



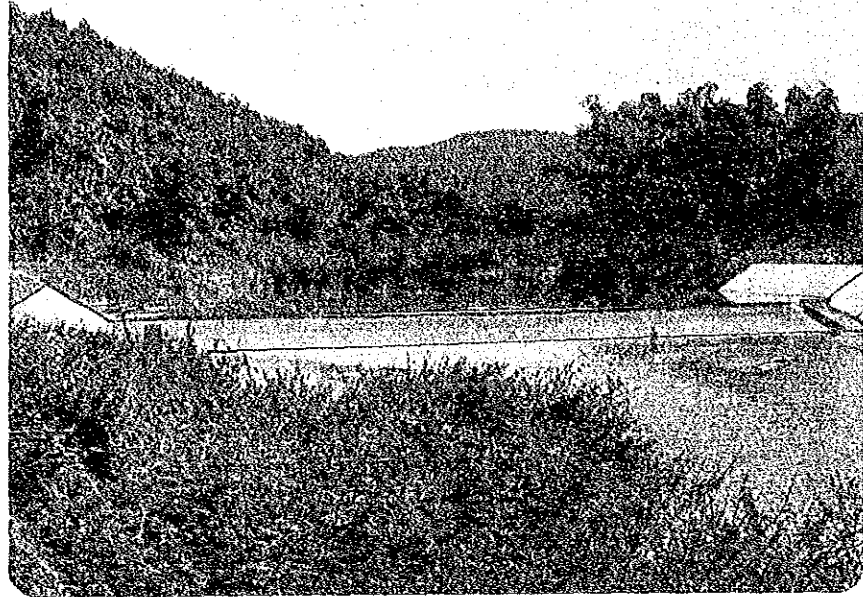
2. Fai Maerai Weir

For wet and dry season irrigation. Irrigable area 500 ha in wet season. Construction cost 8.9 million Yen (1977-1978). Crest length 40 m.



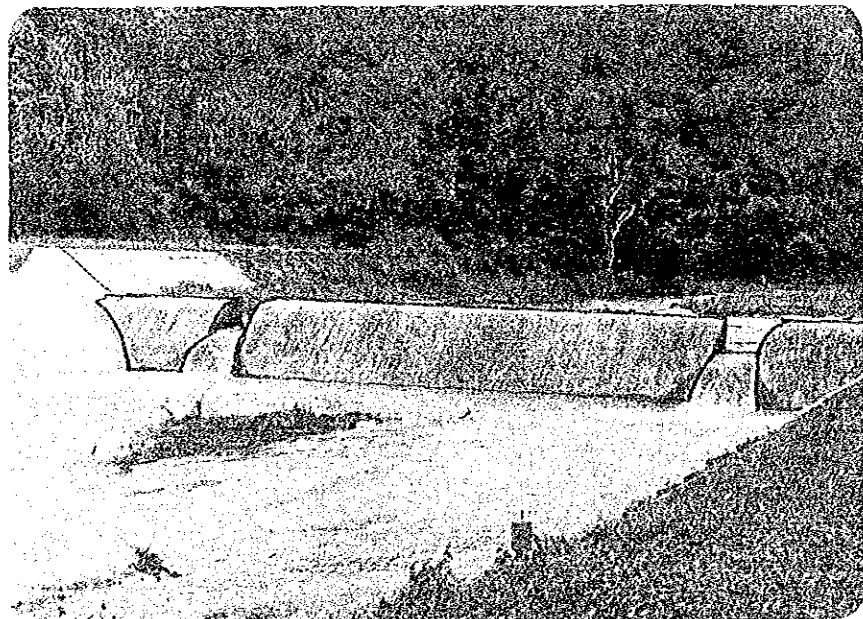
3. Doi Khrang Weir

For wet season irrigation of 1,300 ha. Construction cost 49.9 million Yen (1982). Indian type weir, 50 m in length 2.4 m in height.

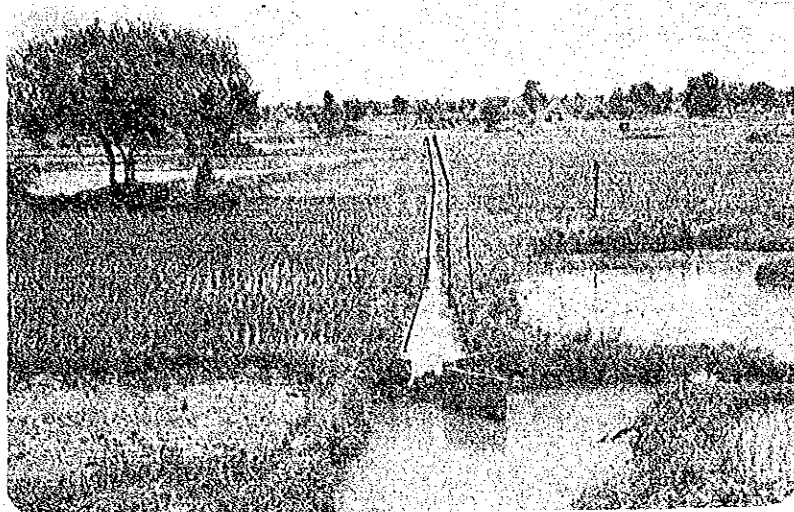


4. Mae Mon Weir

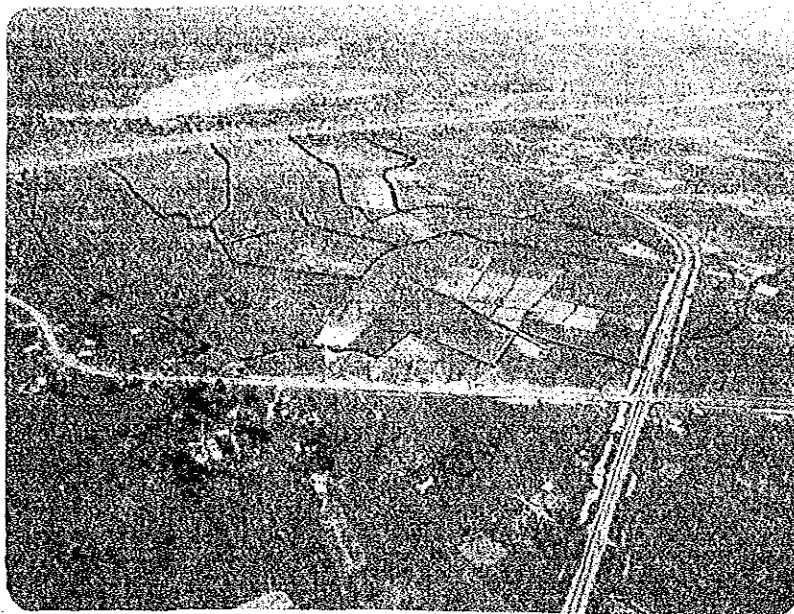
For wet season irrigation of 1,300 ha. Construction cost 13.6 million Yen (1977). Crest length 25 m, height 3.9 m.



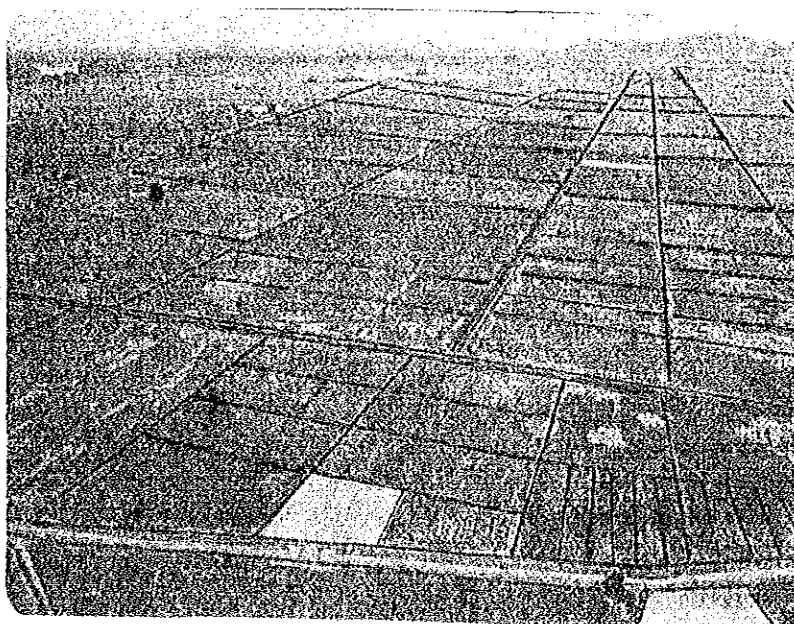
vii On-Farm Development in Thailand



Dikes and  
Ditches Project

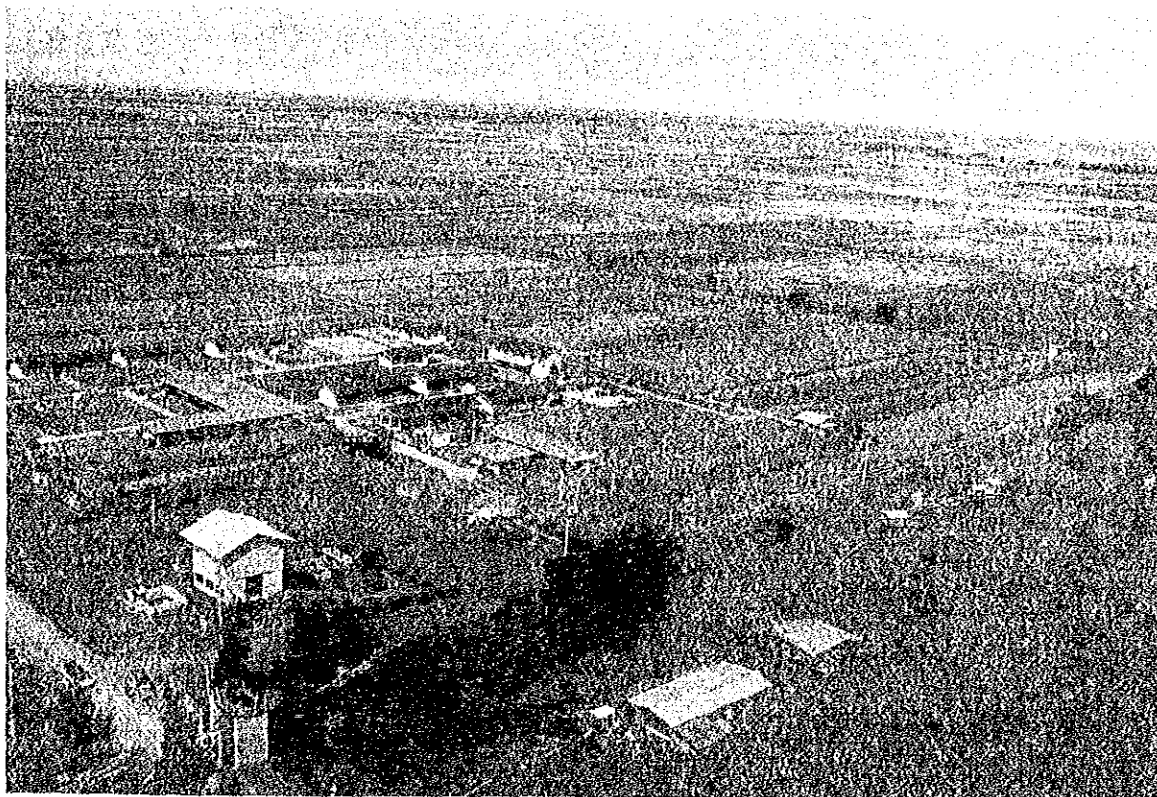
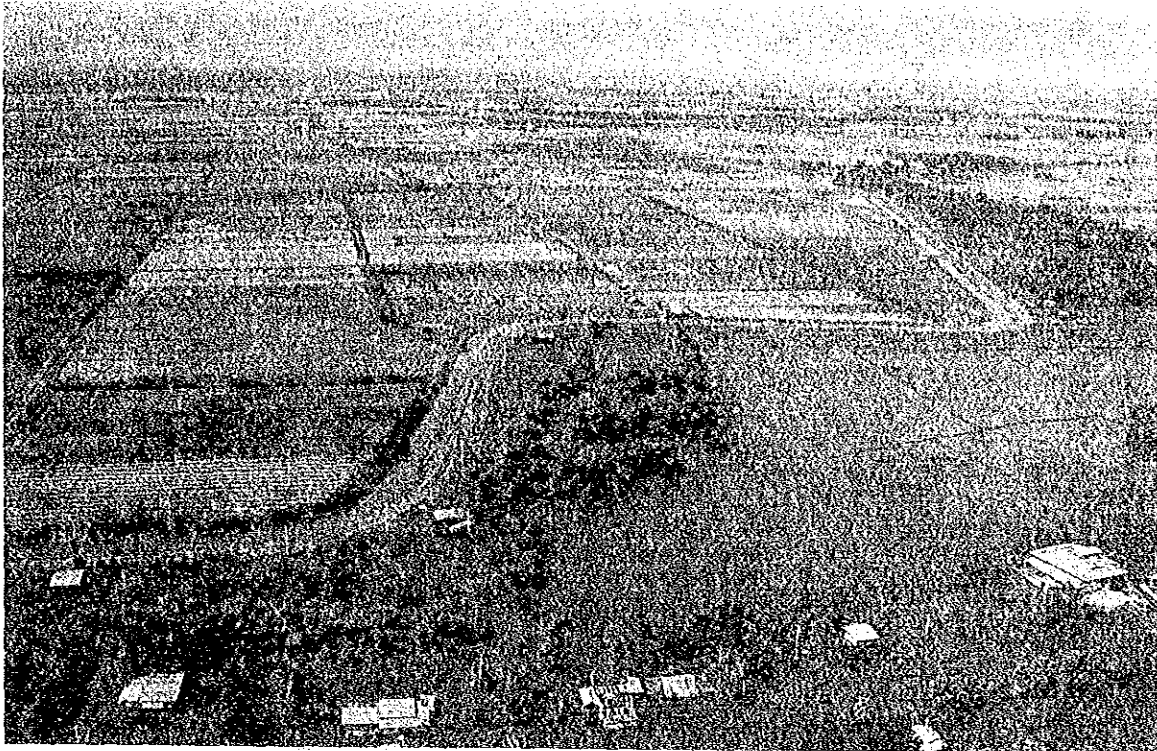


Extensive Land  
Consolidation

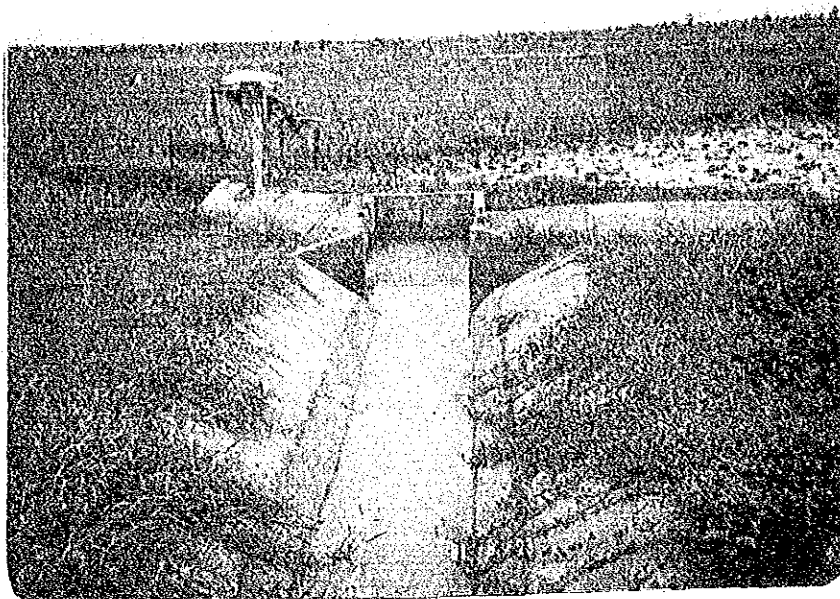


Intensive-Land  
Consolidation

ChaoPhya Pilot Project (Land Consolidation Project in the West bank tract of the ChaoPhya River)

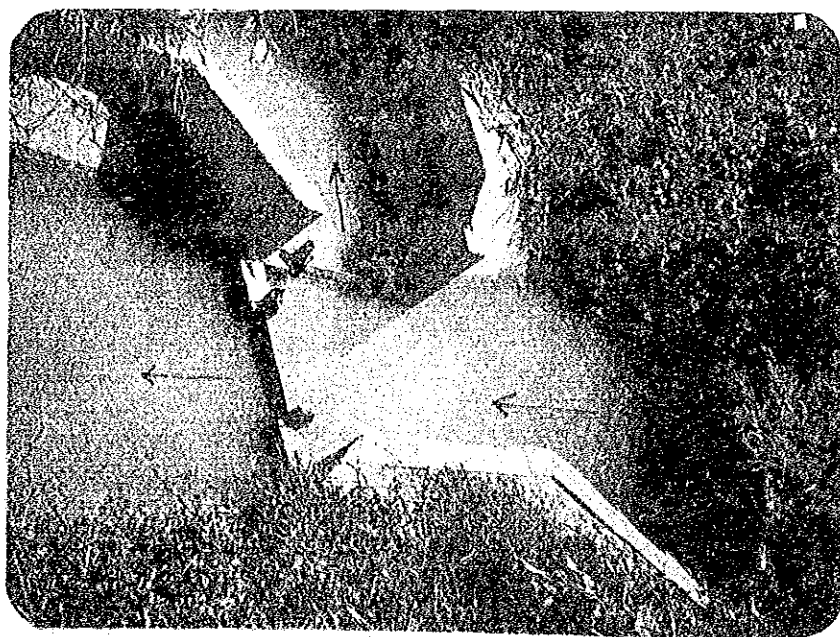
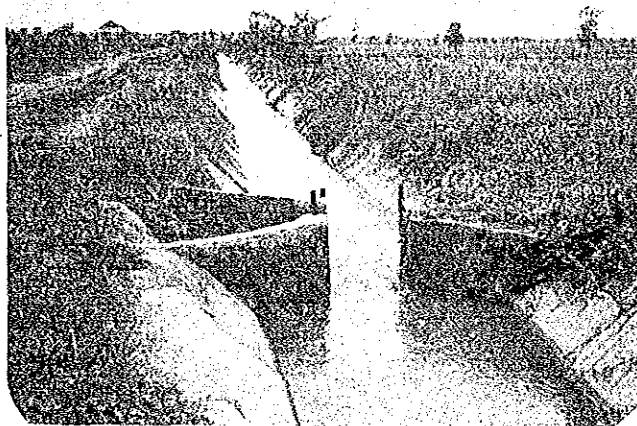


On-farm irrigation facilities



Diversion Box

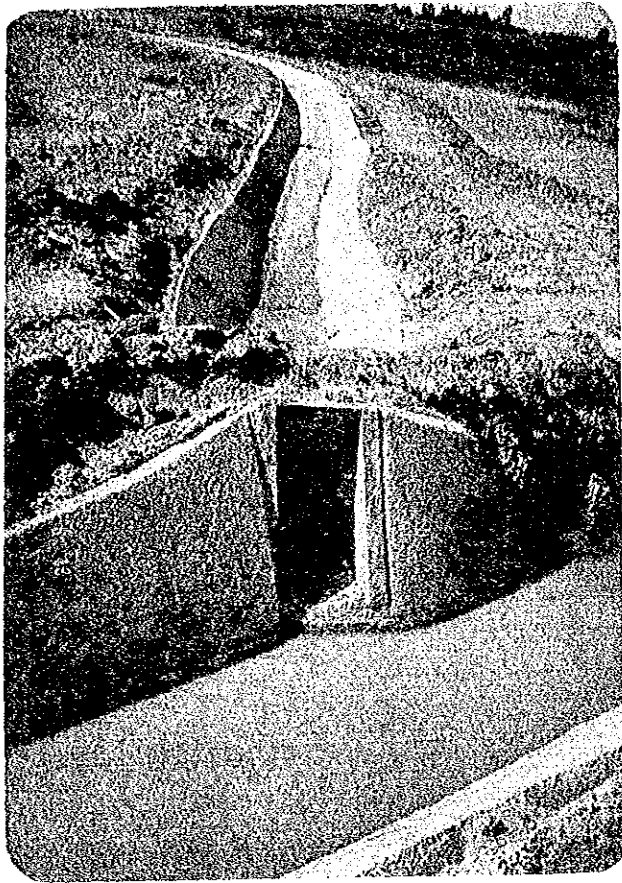
Check structure



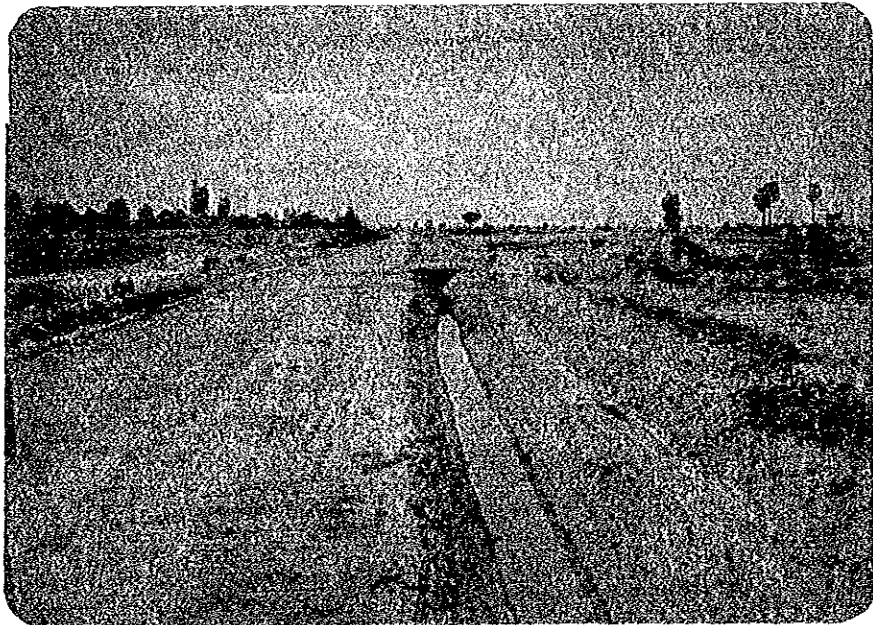
Turnout



Irrigation ditches

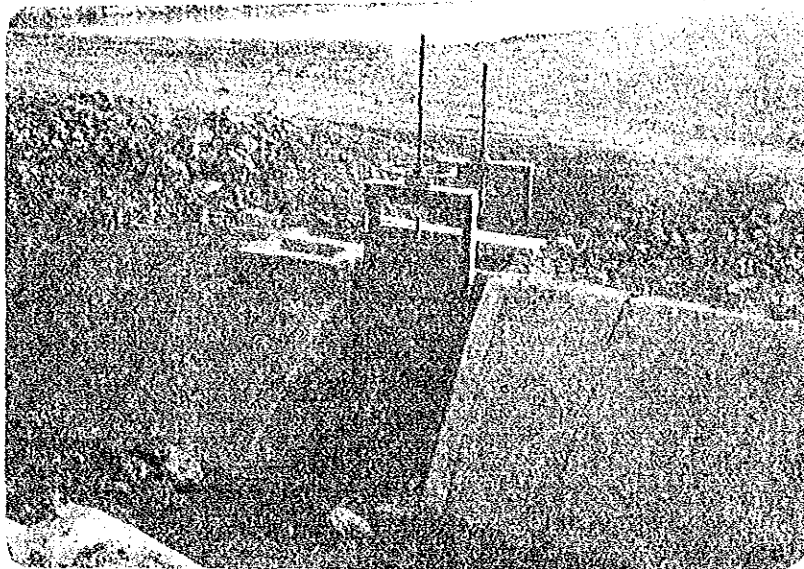
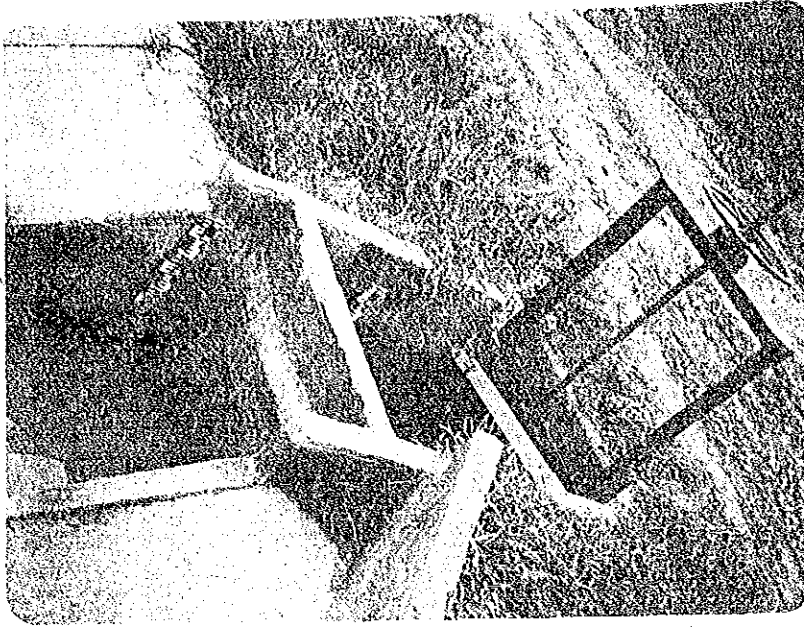


Lined ditch

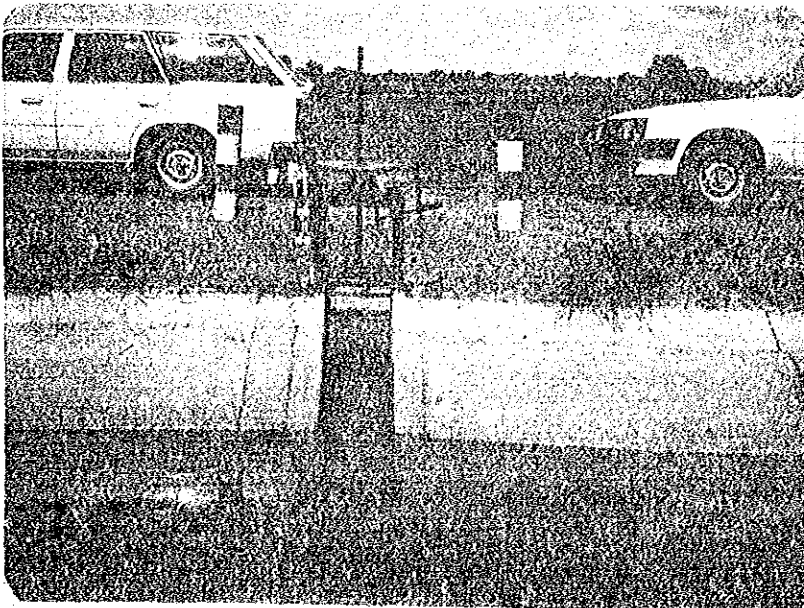


Earth ditch

Offtakes



Constant Head  
Orifice



Romeijin Weir