

- - - - Study Area
 - - - - Priority Area

LEGEND

	Area (Km ²)
Agricultural Lands	
Paddy	1,390
Upland Crops	360
Orchard & Others	110
Non-Agricultural Lands	
	4,440
Total	6,300

SCALE
 0 10 20km

图 3.3.1 土地利用图

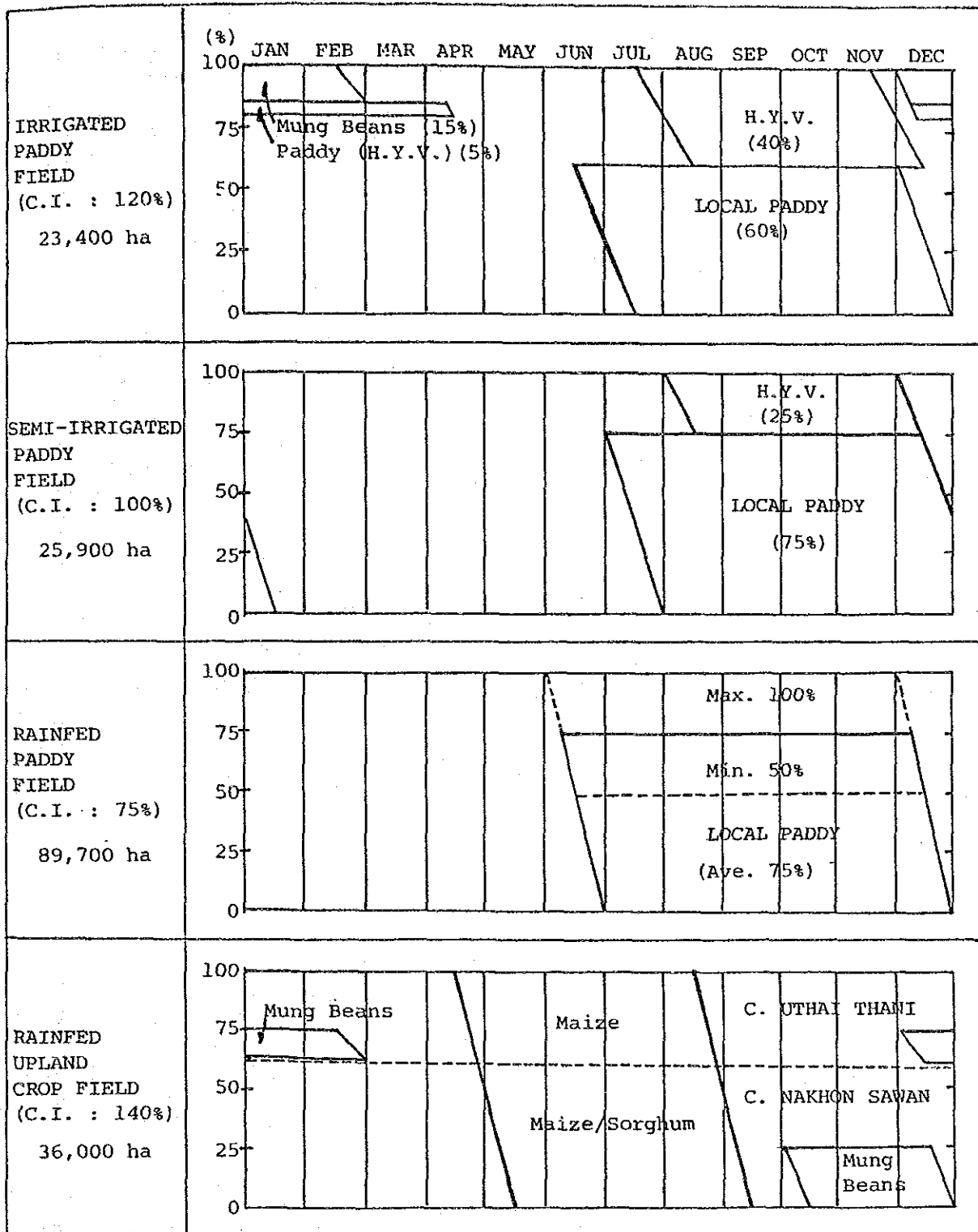


図 3.3.2 現況作付体系

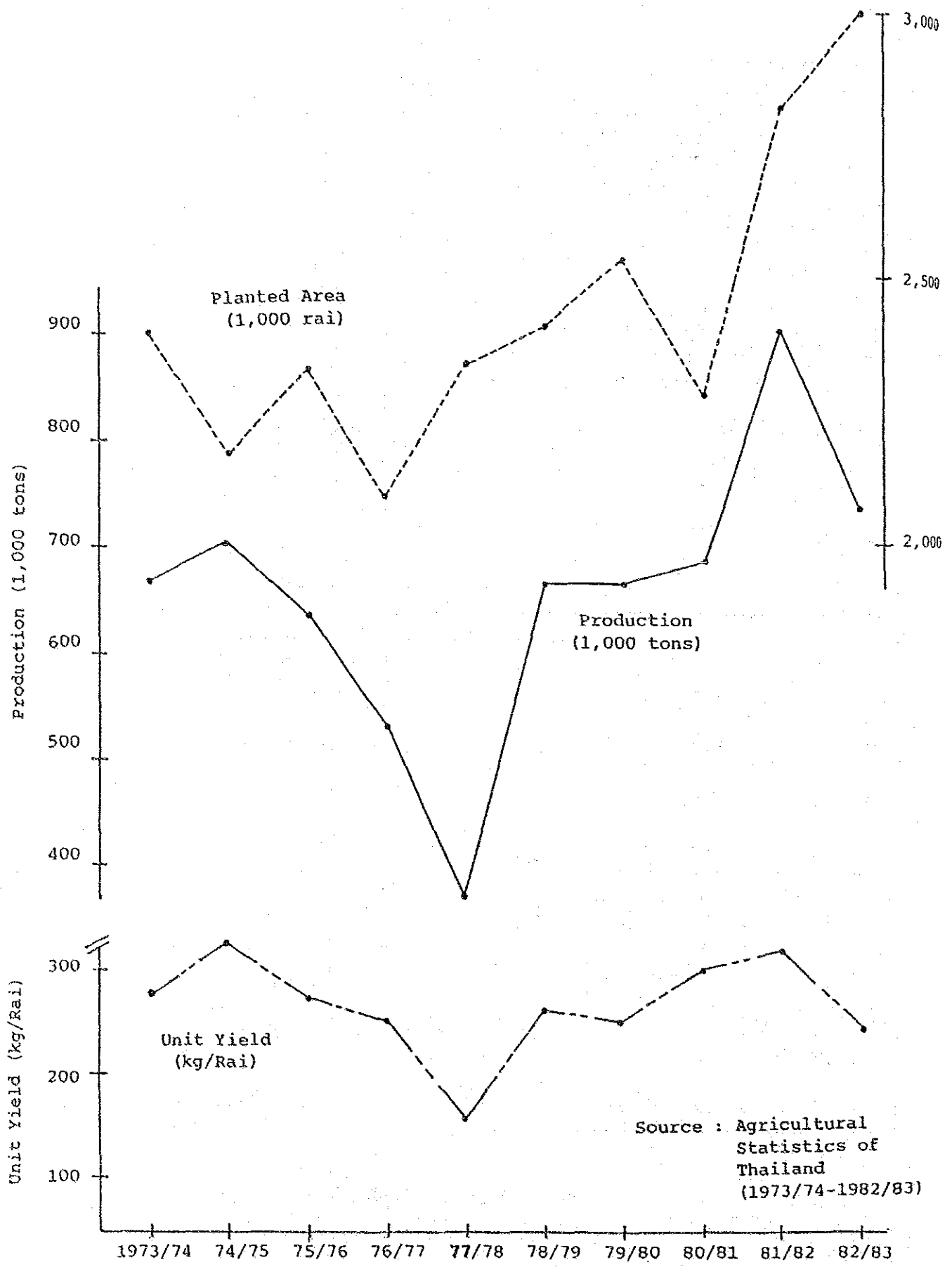


図 3.3.3 水稻生産高経年図 (ウタイタニおよびナコンサワン)

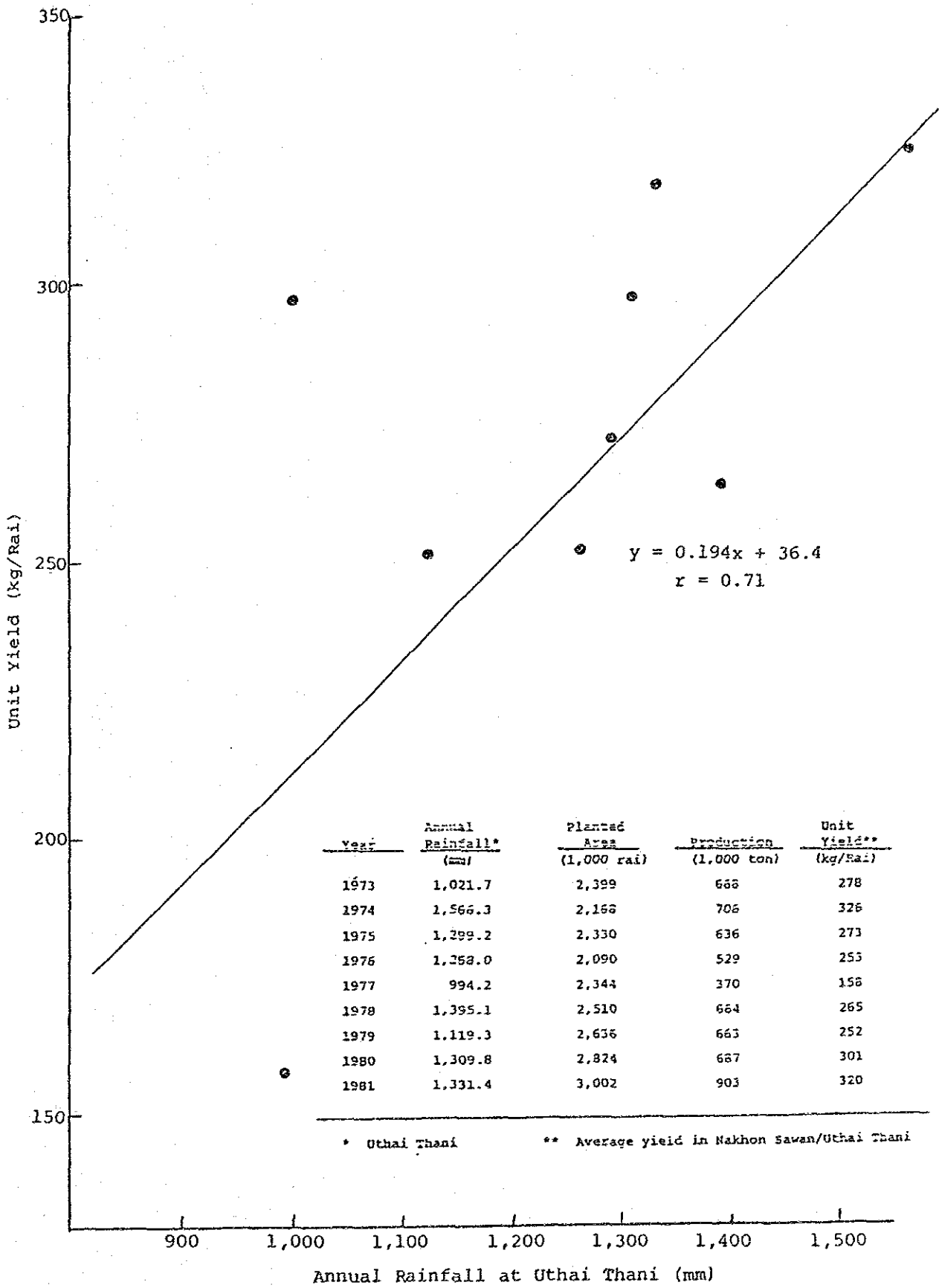
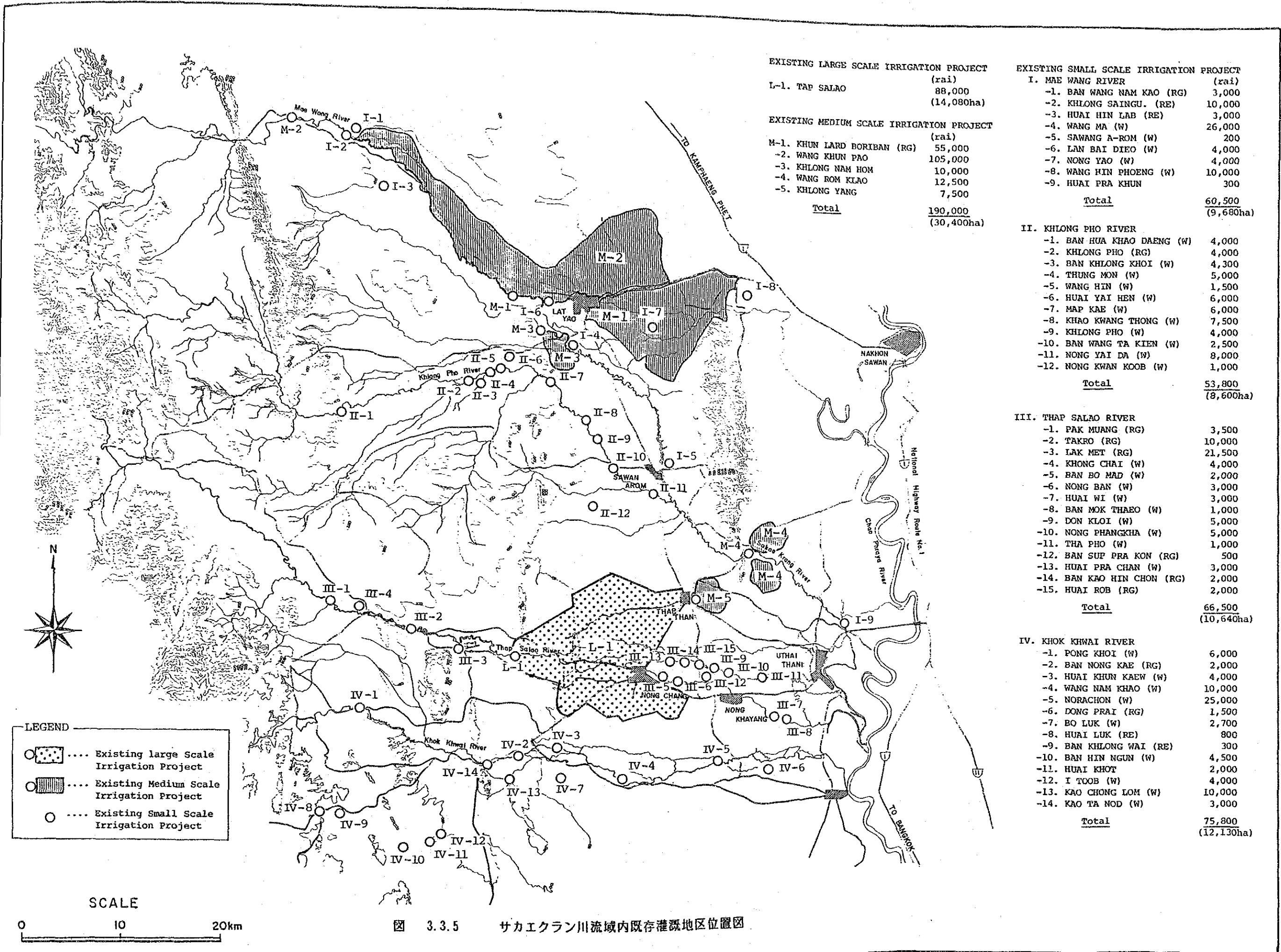


図 3.3.4 水稲収量と年降雨との相関図



EXISTING LARGE SCALE IRRIGATION PROJECT

L-1. TAP SALAO	(rai)	88,000
		(14,080ha)

EXISTING MEDIUM SCALE IRRIGATION PROJECT

M-1. KHUN LARD BORIBAN (RG)	(rai)	55,000
-2. WANG KHUN PAO		105,000
-3. KHLONG NAM HOM		10,000
-4. WANG ROM KLAO		12,500
-5. KHLONG YANG		7,500
Total		190,000
		(30,400ha)

EXISTING SMALL SCALE IRRIGATION PROJECT

I. MAE WANG RIVER	(rai)	
-1. BAN WANG NAM KAO (RG)		3,000
-2. KHLONG SAINGU. (RE)		10,000
-3. HUAI HIN LAB (RE)		3,000
-4. WANG MA (W)		26,000
-5. SAWANG A-ROM (W)		200
-6. LAN BAI DIEO (W)		4,000
-7. NONG YAO (W)		4,000
-8. WANG HIN PHOENG (W)		10,000
-9. HUAI PRA KHUN		300
Total		60,500
		(9,680ha)

II. KHLONG PHO RIVER

-1. BAN HUA KHAO DAENG (W)	4,000
-2. KHLONG PHO (RG)	4,000
-3. BAN KHLONG KHOI (W)	4,300
-4. THUNG MON (W)	5,000
-5. WANG HIN (W)	1,500
-6. HUAI YAI HEN (W)	6,000
-7. MAP KAE (W)	6,000
-8. KHAO KWANG THONG (W)	7,500
-9. KHLONG PHO (W)	4,000
-10. BAN WANG TA KIEN (W)	2,500
-11. NONG YAI DA (W)	8,000
-12. NONG KWAN KOOB (W)	1,000
Total	53,800
	(8,600ha)

III. THAP SALAO RIVER

-1. PAK MUANG (RG)	3,500
-2. TAKRO (RG)	10,000
-3. LAK MET (RG)	21,500
-4. KHONG CHAI (W)	4,000
-5. BAN BO MAD (W)	2,000
-6. NONG BAN (W)	3,000
-7. HUAI WI (W)	3,000
-8. BAN MOK THAEO (W)	1,000
-9. DON KLOI (W)	5,000
-10. NONG PHANGKHA (W)	5,000
-11. THA PHO (W)	1,000
-12. BAN SUP PRA KON (RG)	500
-13. HUAI PRA CHAN (W)	3,000
-14. BAN KAO HIN CHON (RG)	2,000
-15. HUAI ROB (RG)	2,000
Total	66,500
	(10,640ha)

IV. KHOK KHWAI RIVER

-1. PONG KHOI (W)	6,000
-2. BAN NONG KAE (RG)	2,000
-3. HUAI KHUN KAEW (W)	4,000
-4. WANG NAM KHAO (W)	10,000
-5. NORACHON (W)	25,000
-6. DONG PRAI (RG)	1,500
-7. BO LUK (W)	2,700
-8. HUAI LUK (RE)	800
-9. BAN KHLONG WAI (RE)	300
-10. BAN HIN NGUN (W)	4,500
-11. HUAI KHOT	2,000
-12. I TOOB (W)	4,000
-13. KAO CHONG LOM (W)	10,000
-14. KAO TA NOD (W)	3,000
Total	75,800
	(12,130ha)

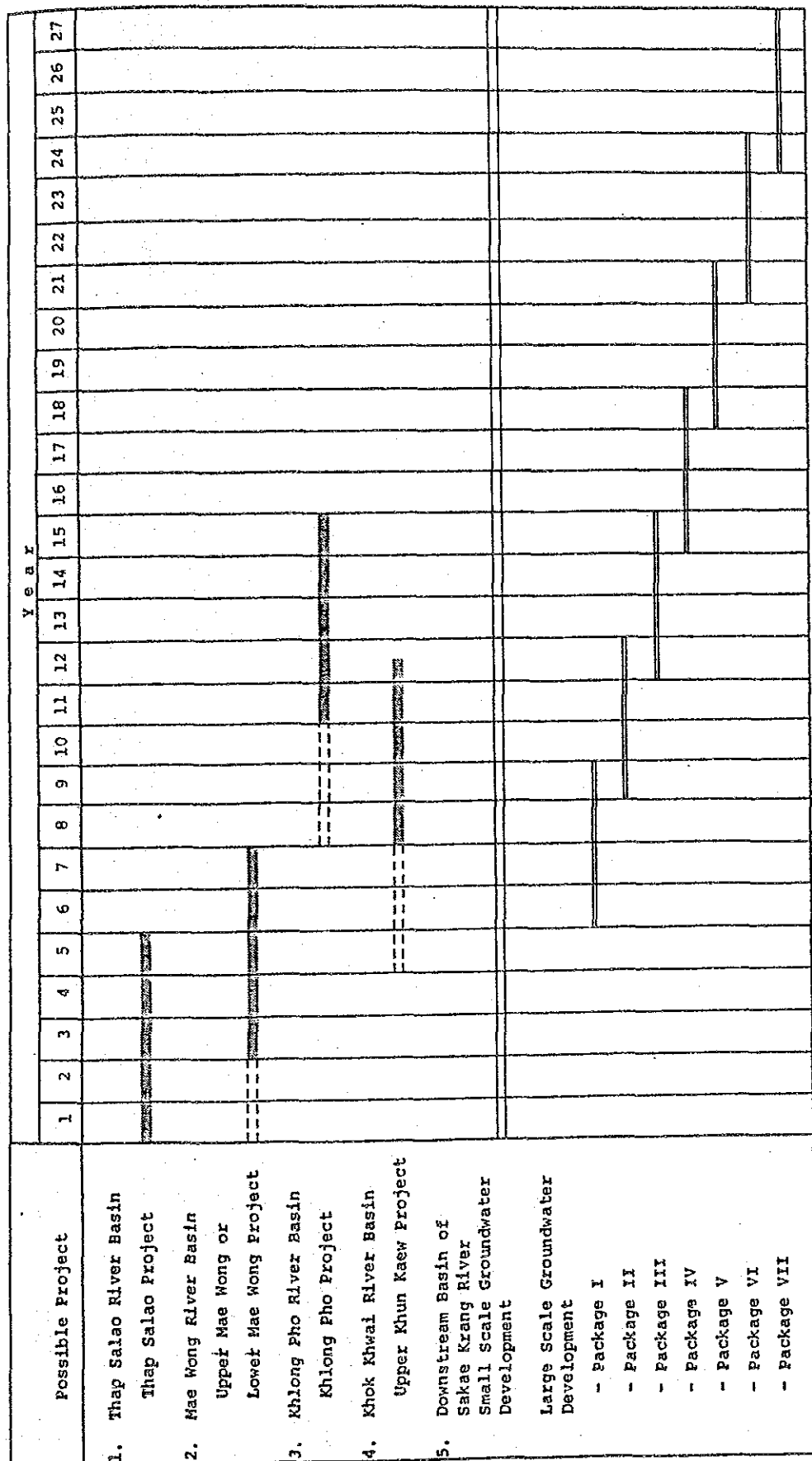
LEGEND

- Existing large Scale Irrigation Project
- Existing Medium Scale Irrigation Project
- Existing Small Scale Irrigation Project

SCALE

0 10 20km

図 3.3.5 サカエ克蘭川流域内既存灌漑地区位置図



Legend

- Investigation, Feasibility Study, Detailed Design and Loan Arrangement
- ▨ Construction
- ==== Investigation and Construction
- ==== Investigation, Studies, Design and Construction

Fig. 図 3.6.1 サカエクラン川流域全体開発実施工程図

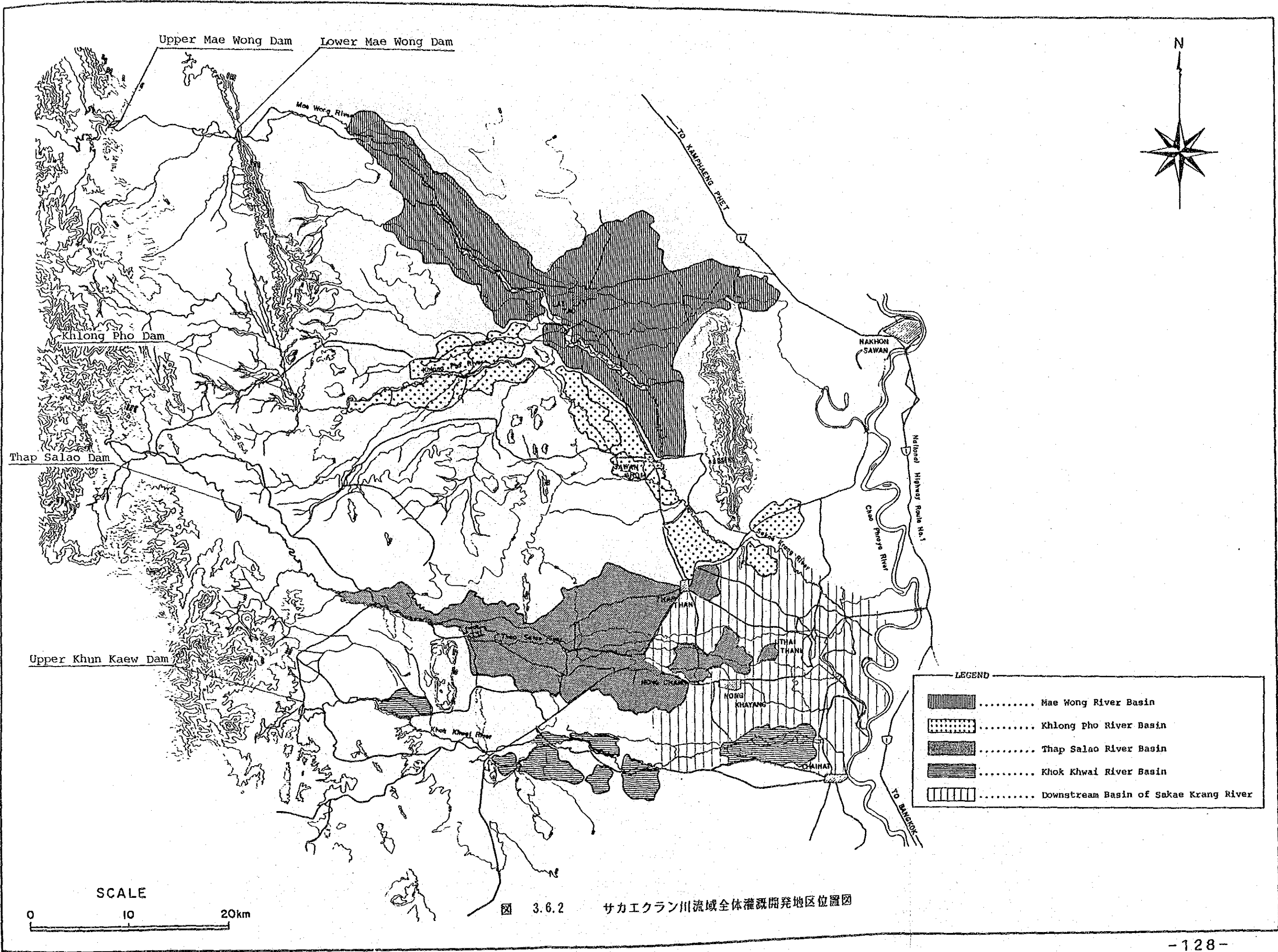
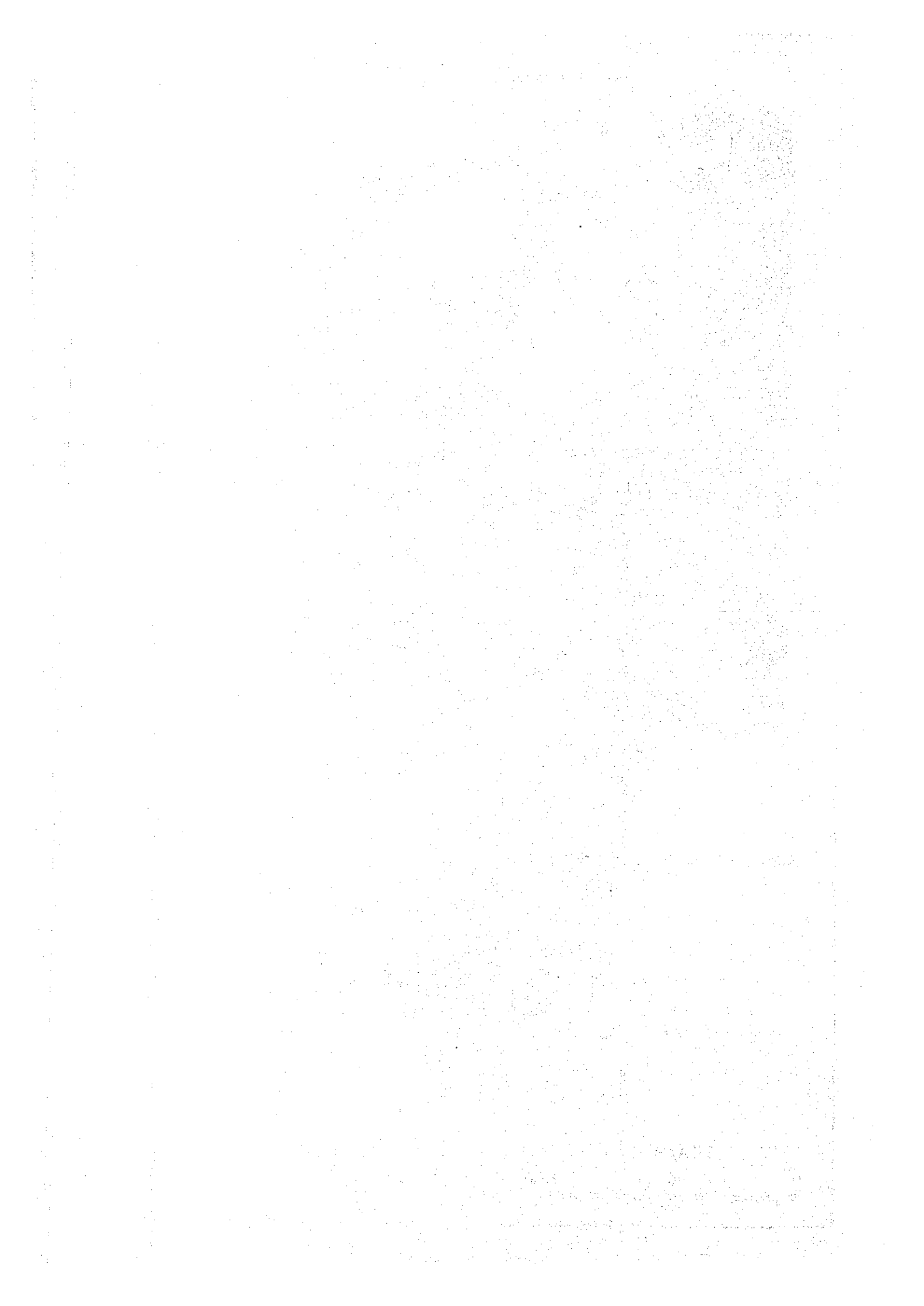


図 3.6.2 サカエ克蘭川流域全体灌溉開発地区位置図



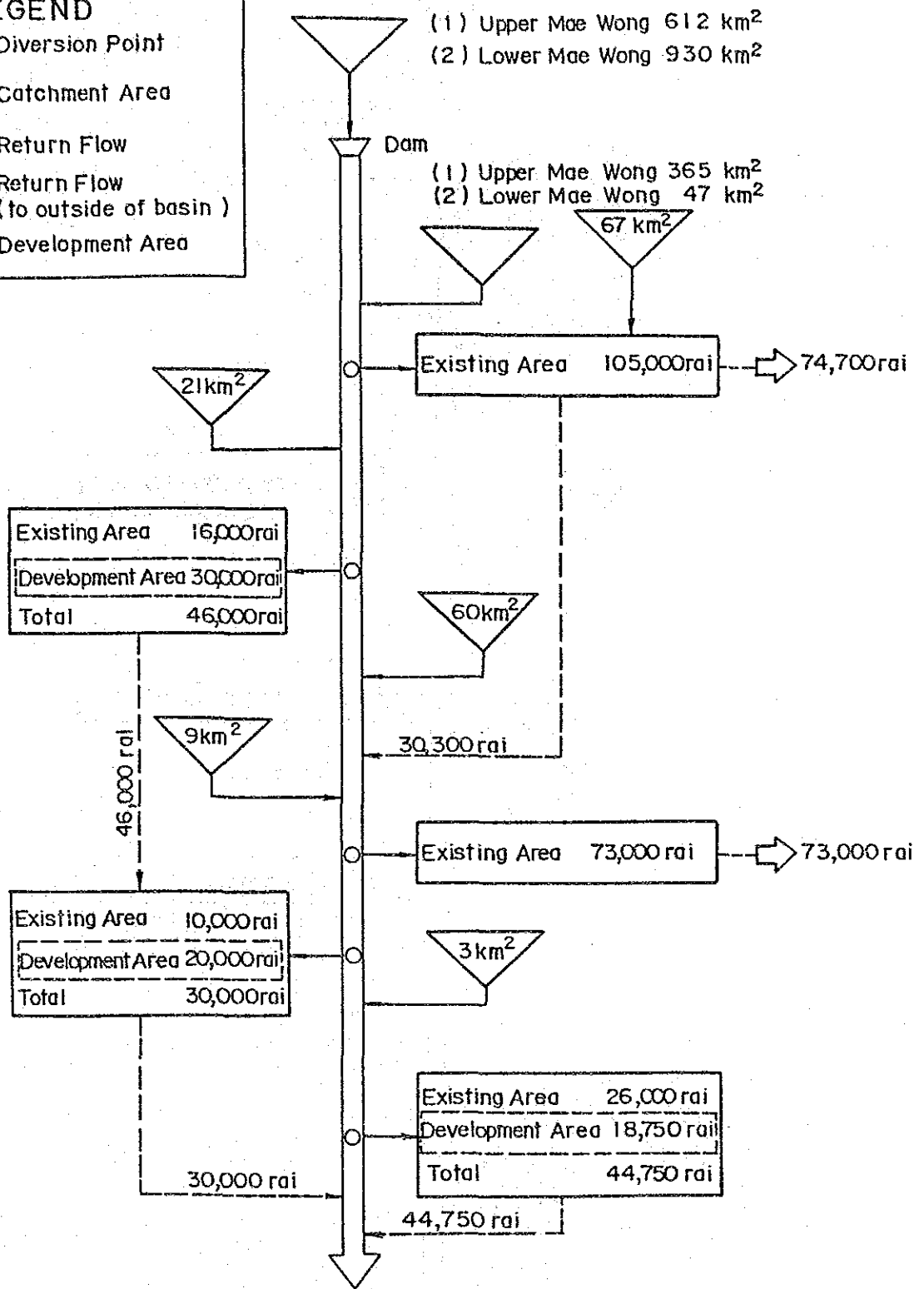
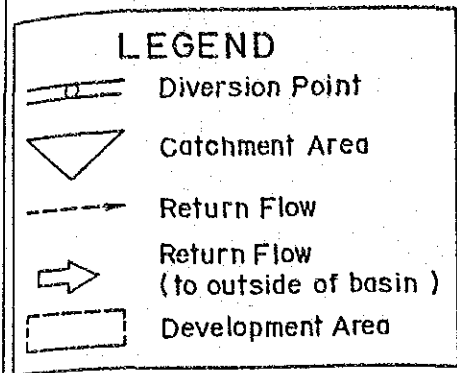


図 4.3.1 計画灌漑系統図 (メウオン川流域)

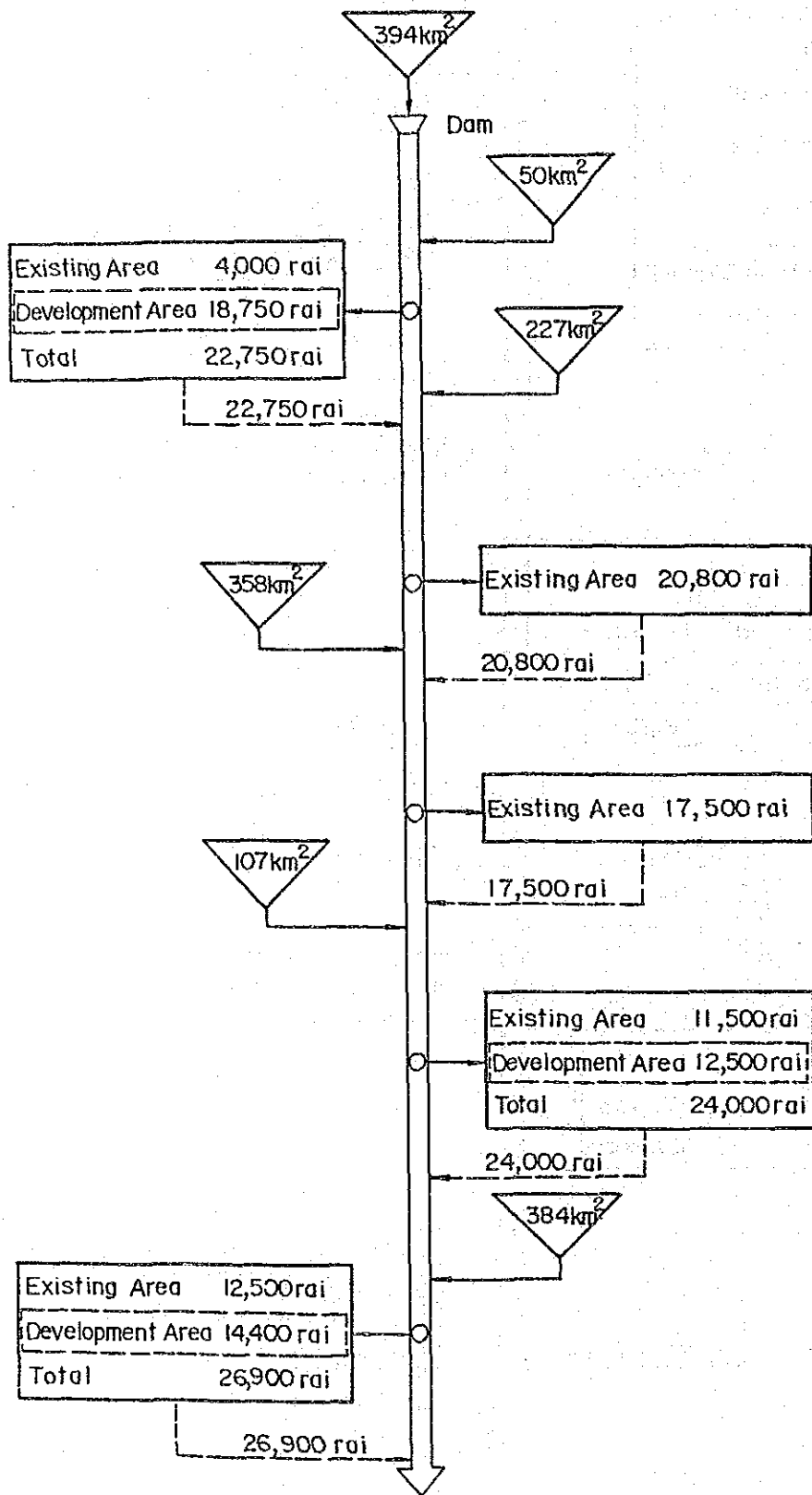


図 4.3.2 計画灌漑系統図 (クロンポー川流域)

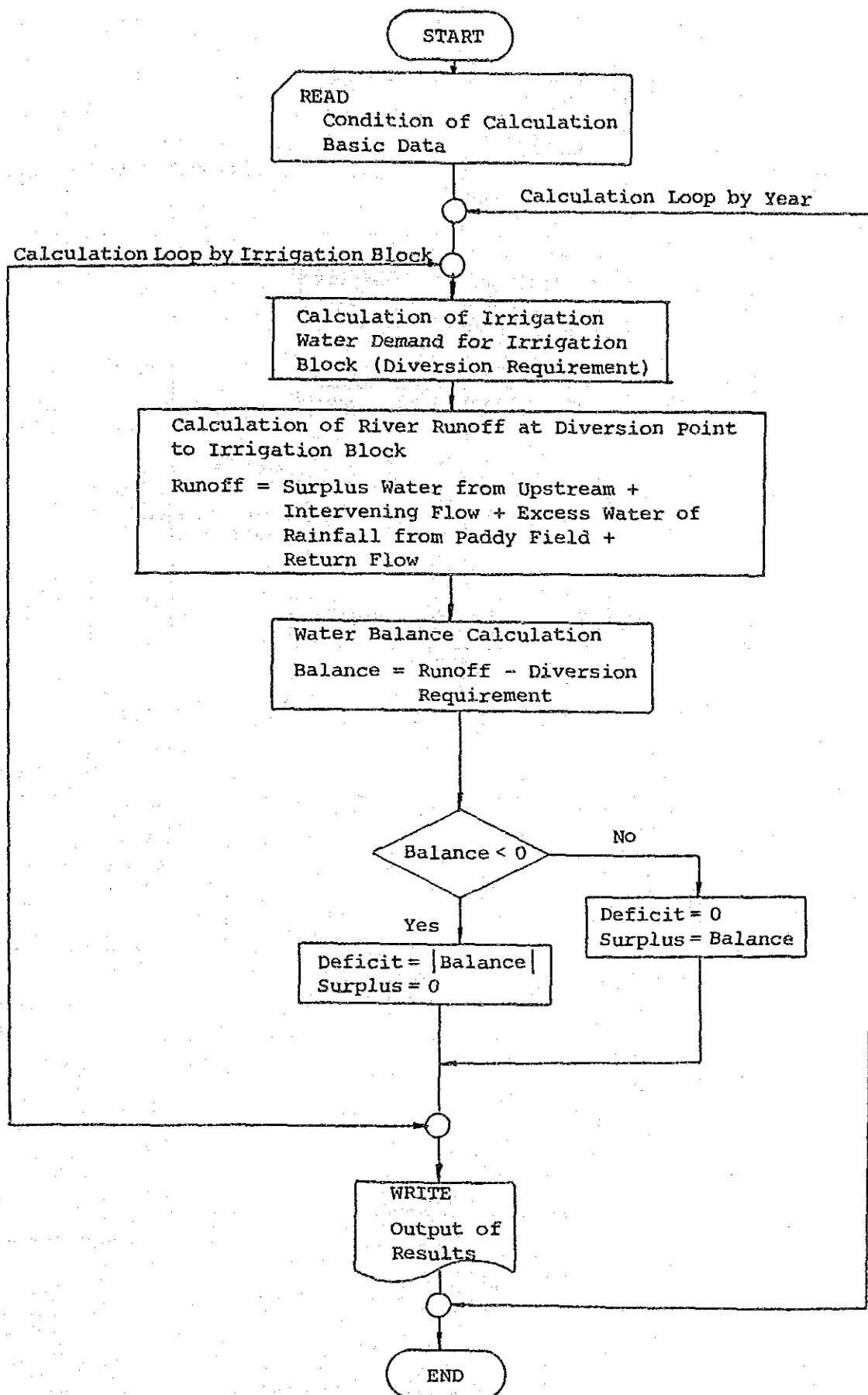


図 4.3.3 水収支計算流れ図

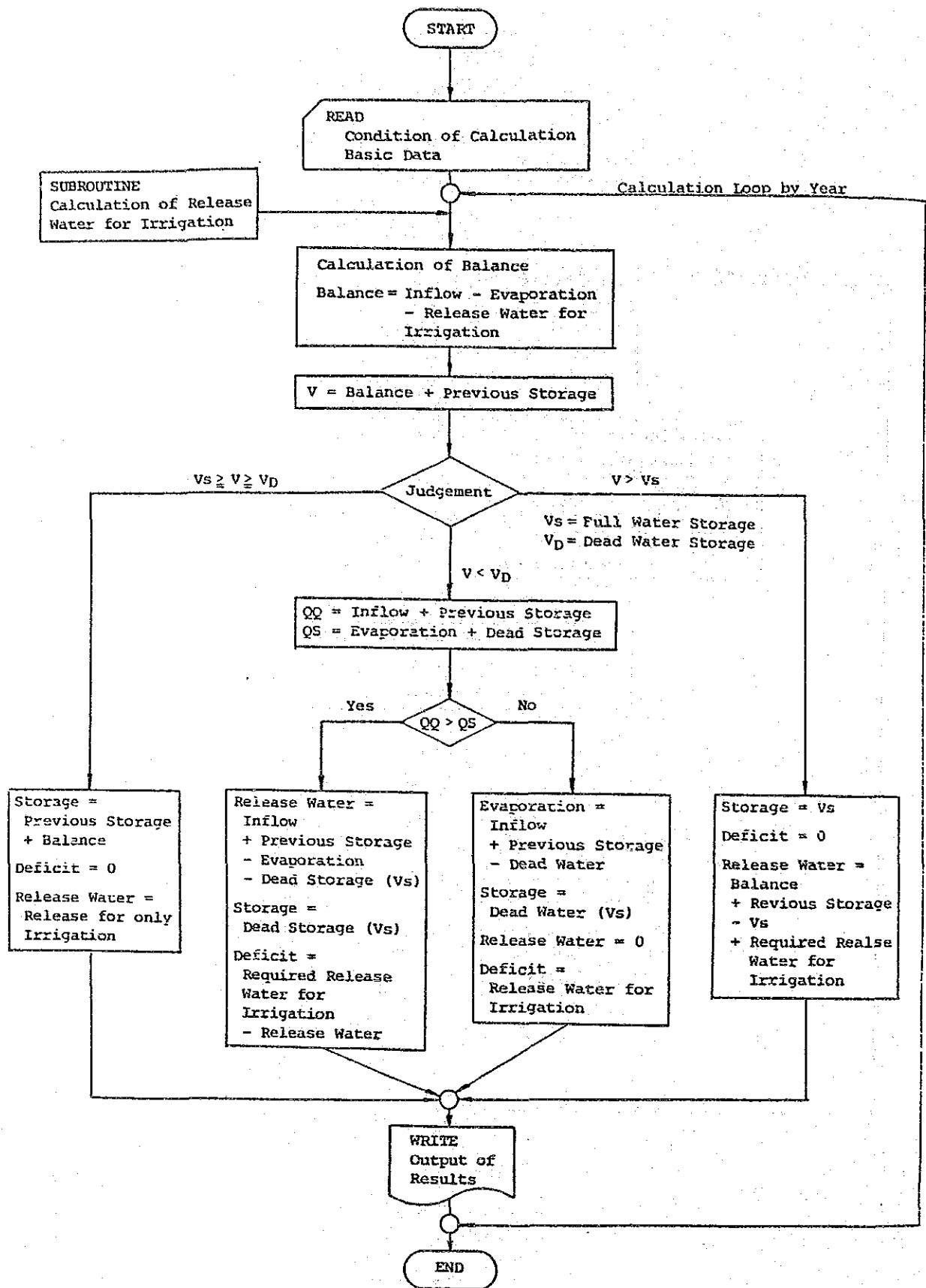
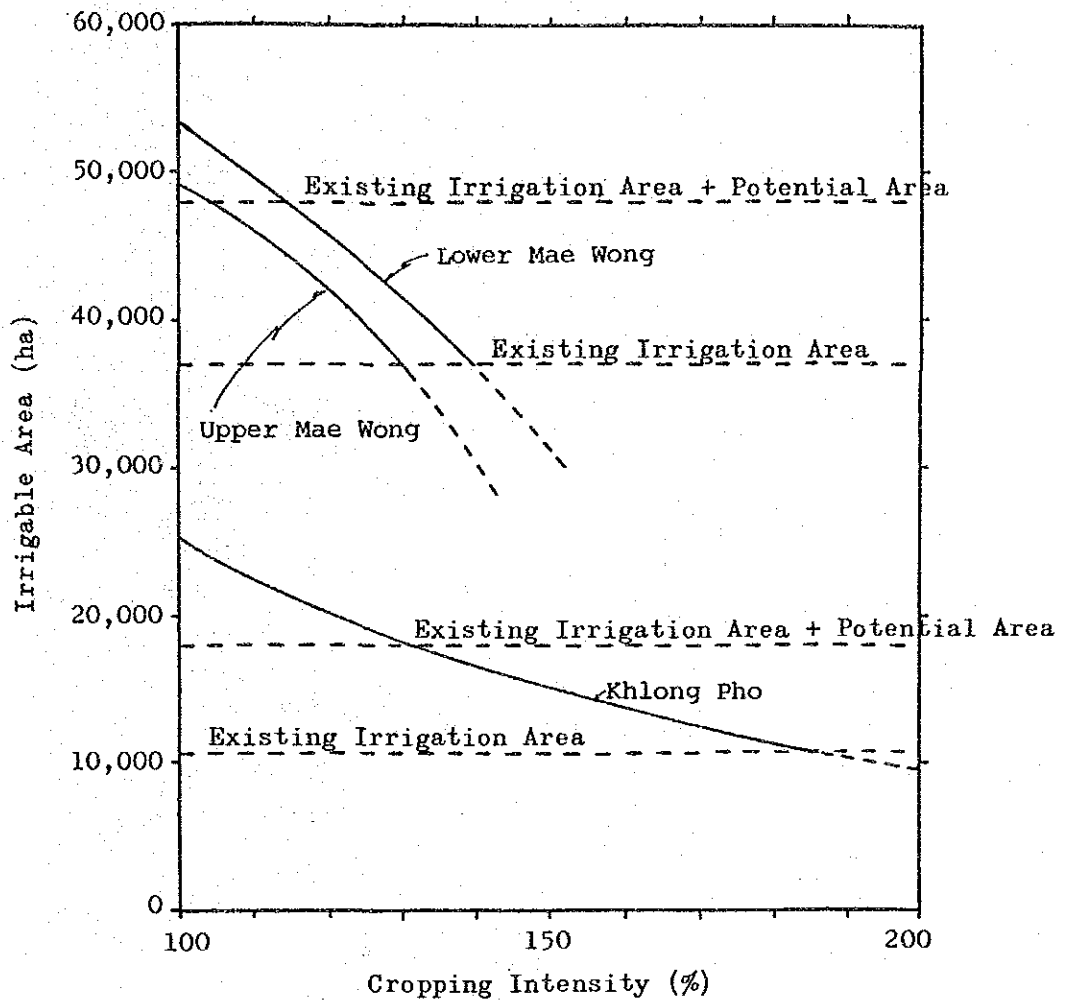


図 4.3.4 貯水池水取支計算流れ図



Note

Cropping Pattern: Paddy + Mung Bean

Overall Irrigation Efficiency: 55 %

Reservoir Capacity:	Lower Mae Wong	350 MCM
	Upper Mae Wong	230 MCM
	Khlong Pho	96 MCM

図 4.3.5 開発灌漑面積と作付率の関係図

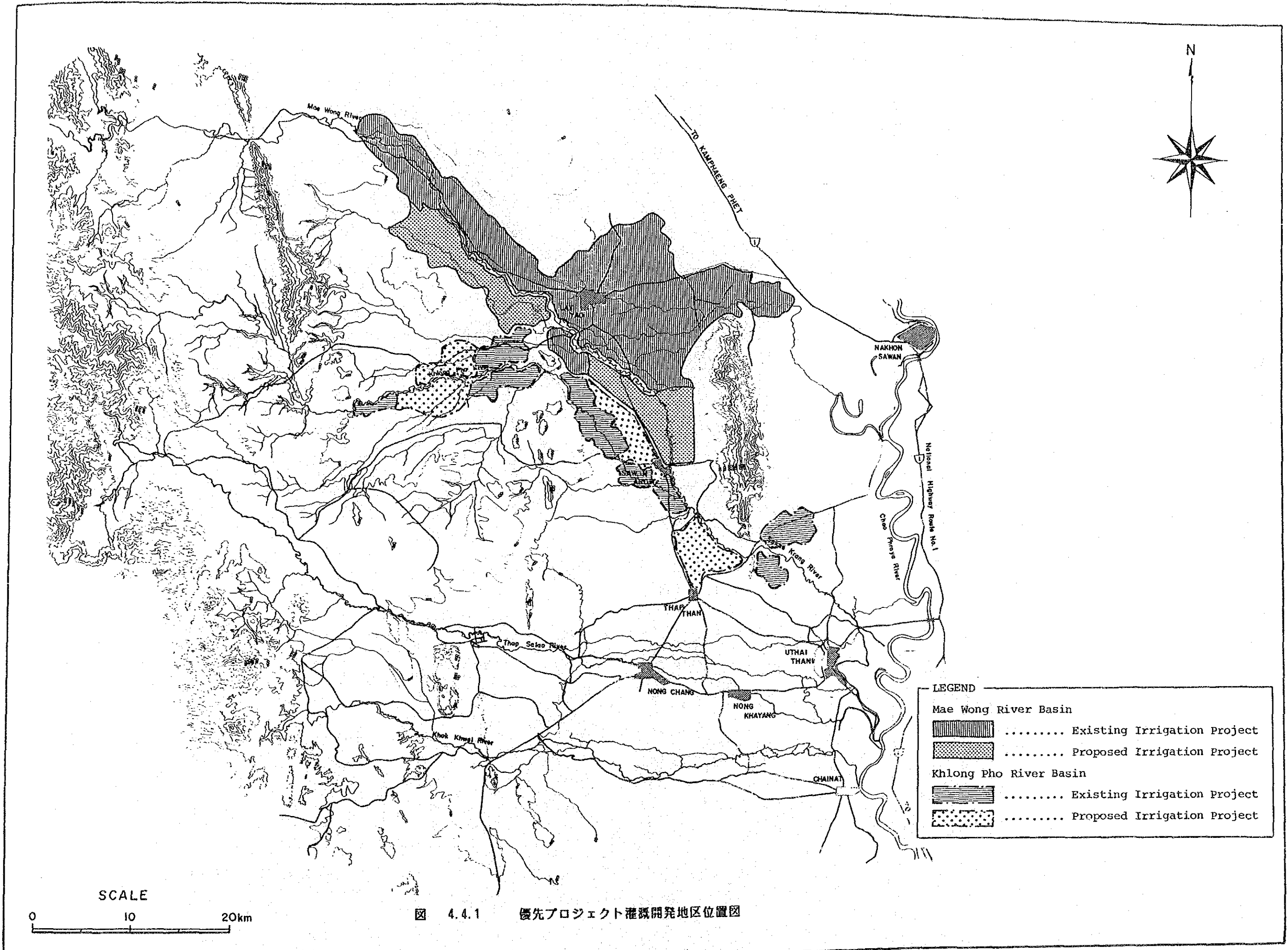
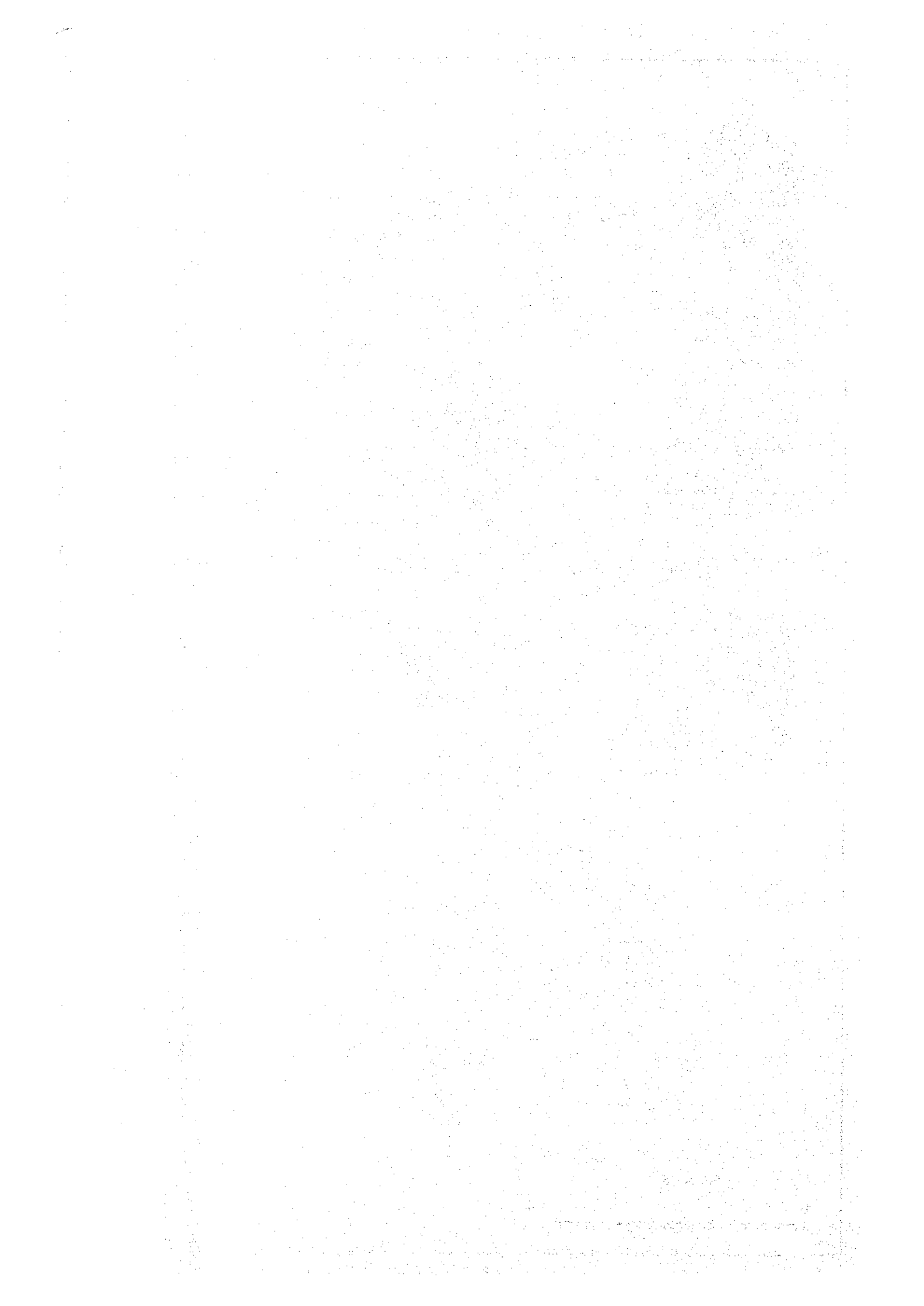


図 4.4.1 優先プロジェクト灌漑開発地区位置図



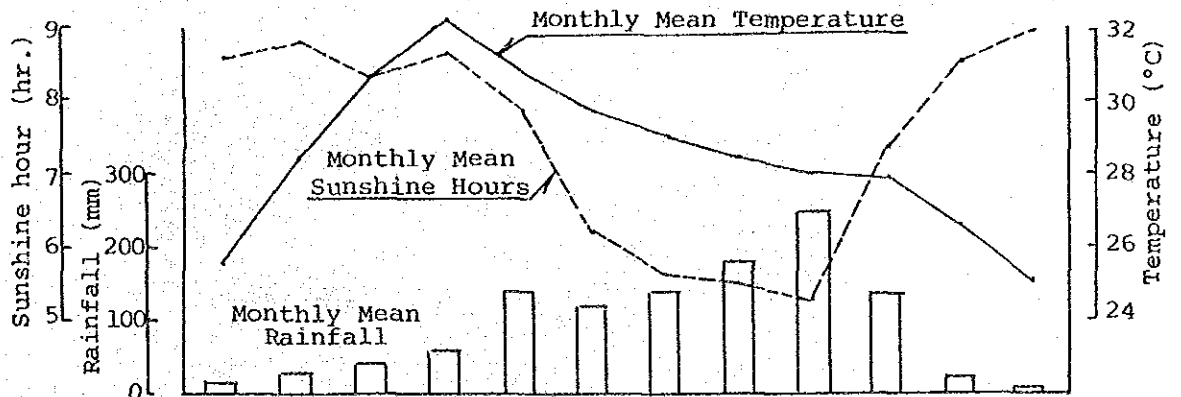
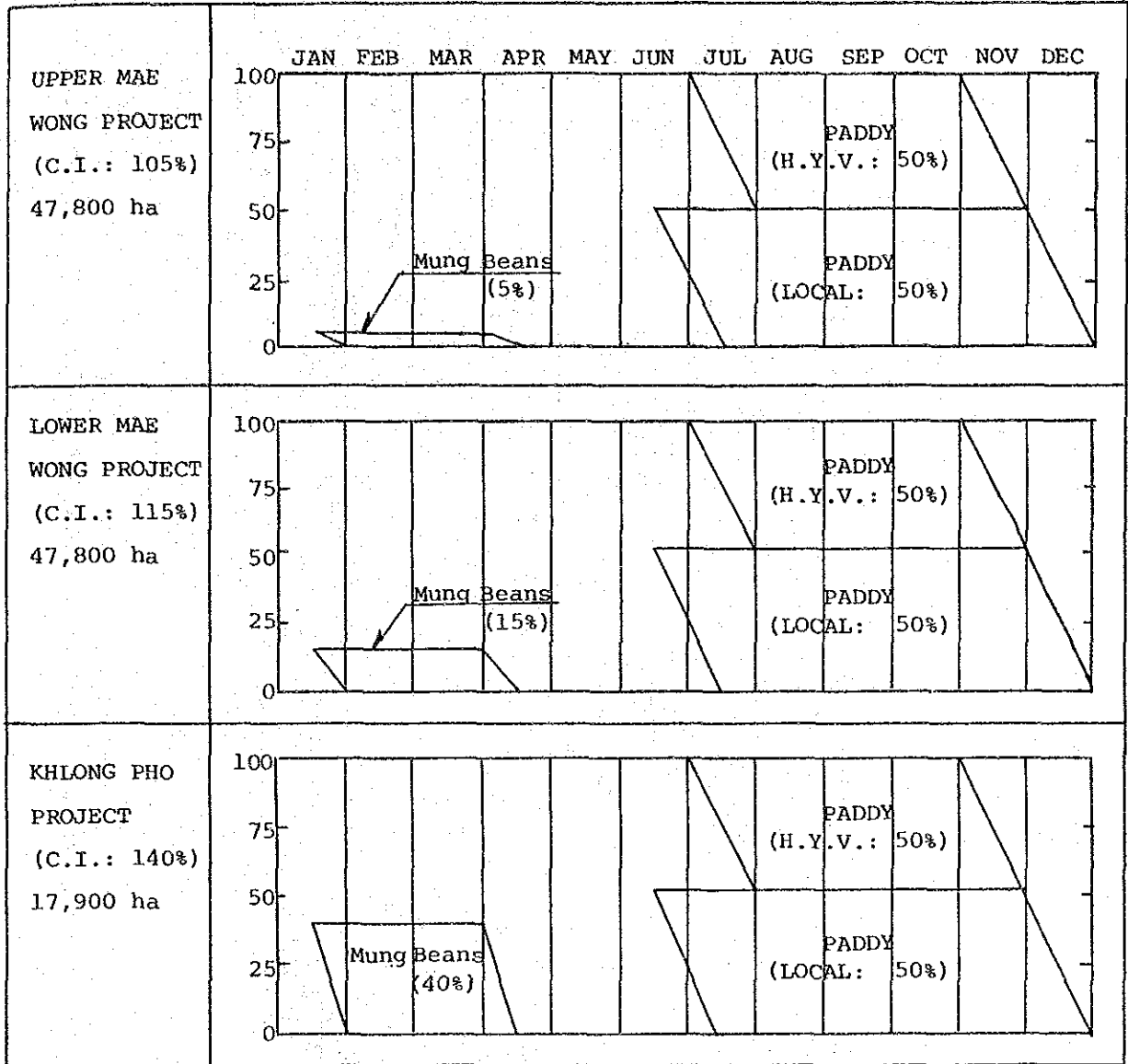
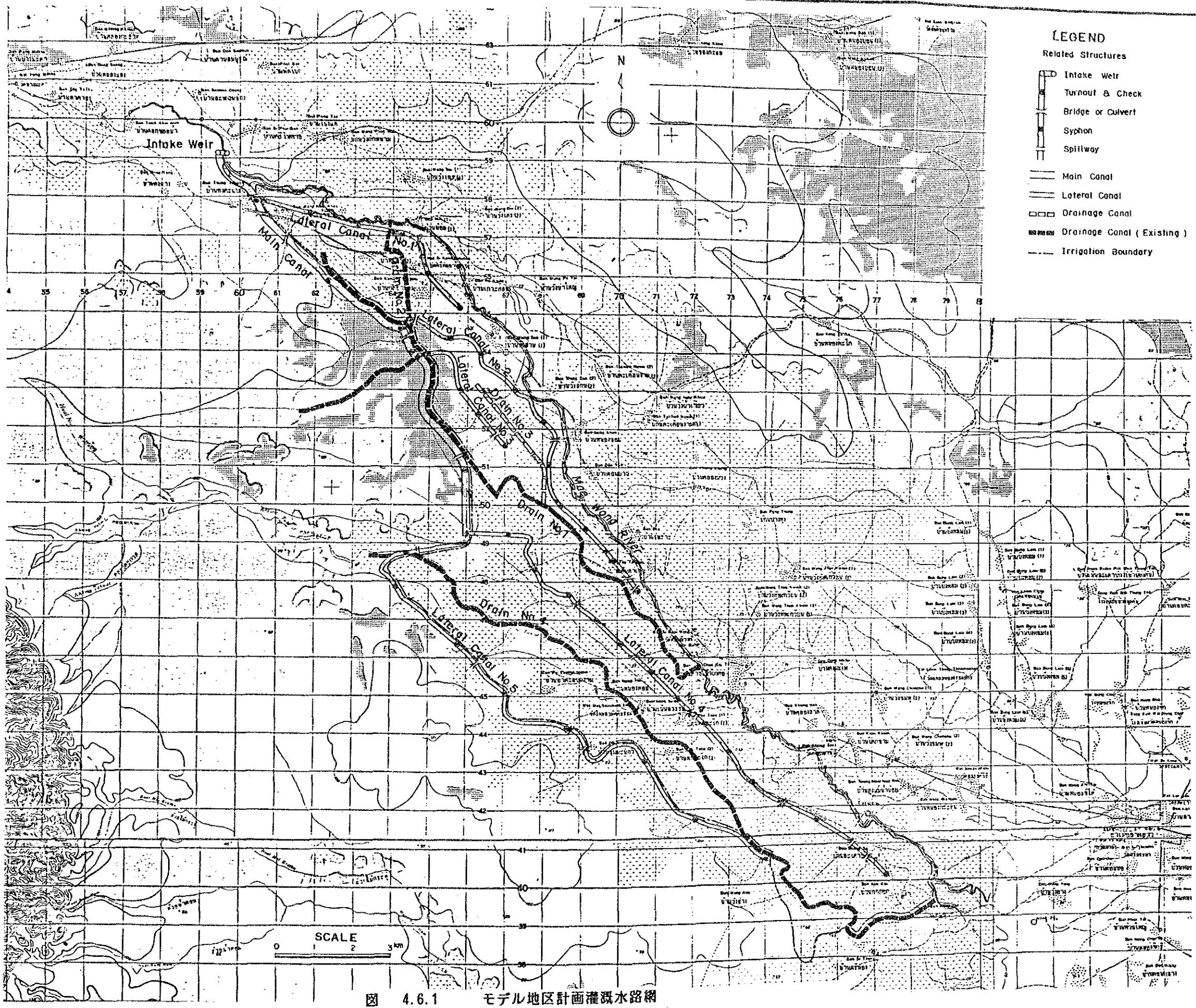


图 4.5.1 計畫作付体系



- LEGEND**
- Related Structures
- Intake Weir
 - Turnout & Check
 - Bridge or Culvert
 - Syphon
 - Spillway
- Main Canal
- Lateral Canal
- Drainage Canal
- Drainage Canal (Existing)
- Irrigation Boundary

図 4.6.1 モデル地区計画灌漑水路網

LEGEND

- Intake Weir (Proposed)
- Intake Weir (Existing)
- ▬ Main Canal (Proposed)
- ▬ Main Canal (Existing)
- ▬ Lateral Canal (Proposed)
- ▬ Lateral Canal (Existing)
- ▬ Drainage Canal (Proposed)
- ▬ Drainage Canal (Existing)
- Irrigation Boundary
- Existing Irrigated Area
- ▨ Proposed Irrigated Area

CHANGWAT NAKHON SAWI

SCALE
0 1 2 3 4 5 km

図 4.6.2 優先プロジェクト計画灌漑水路網

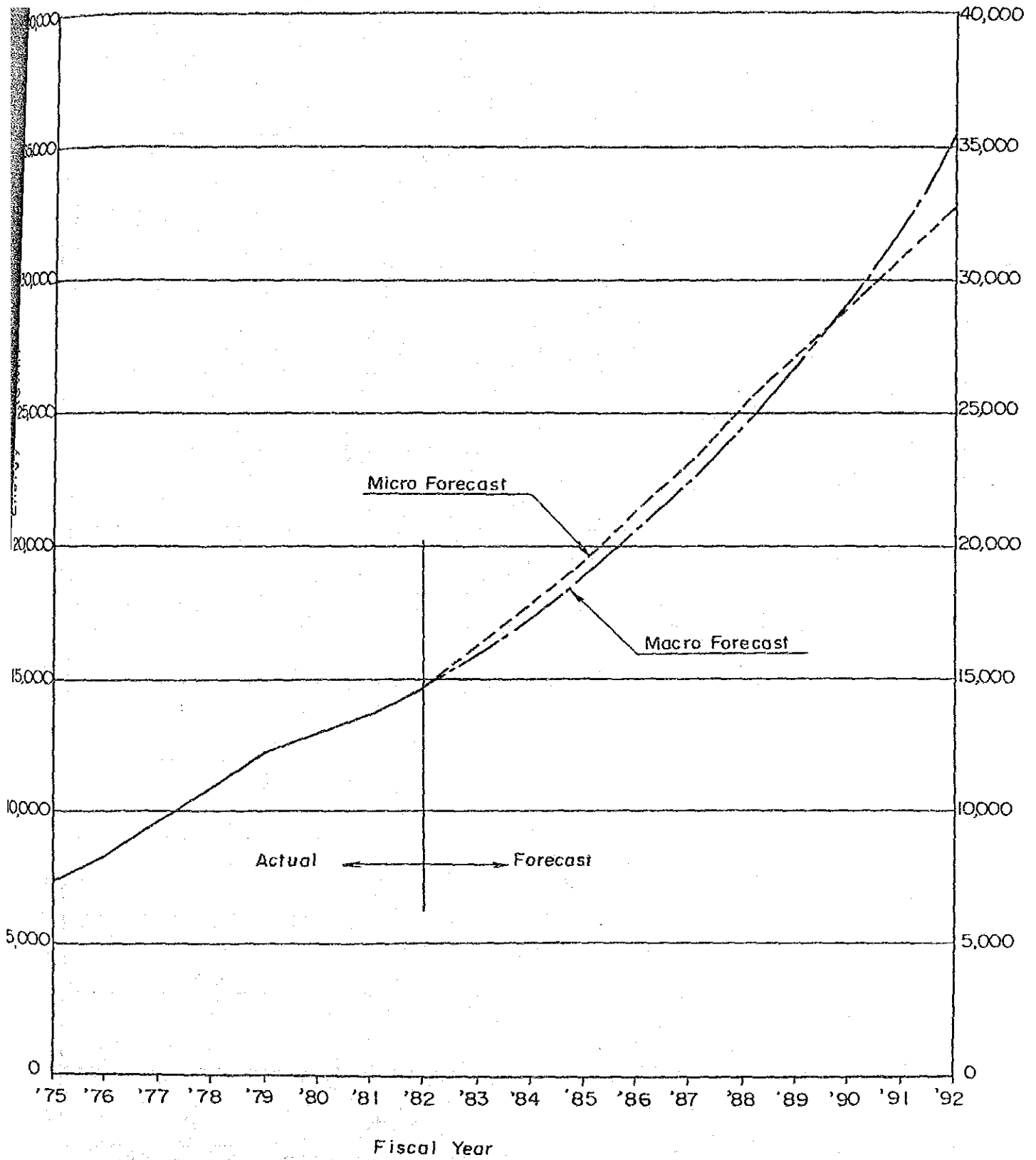


圖 4.7.1 電力需要予測

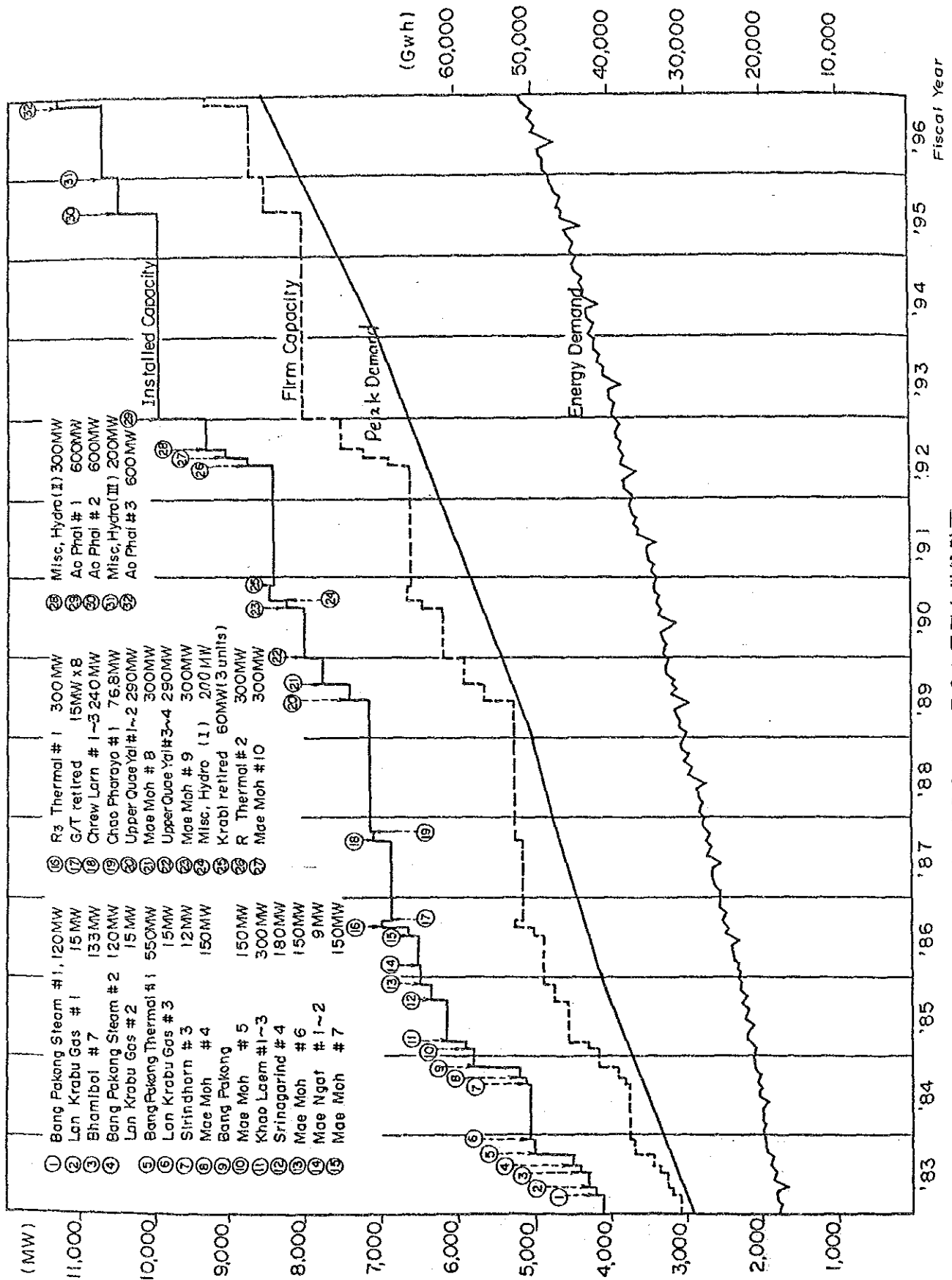
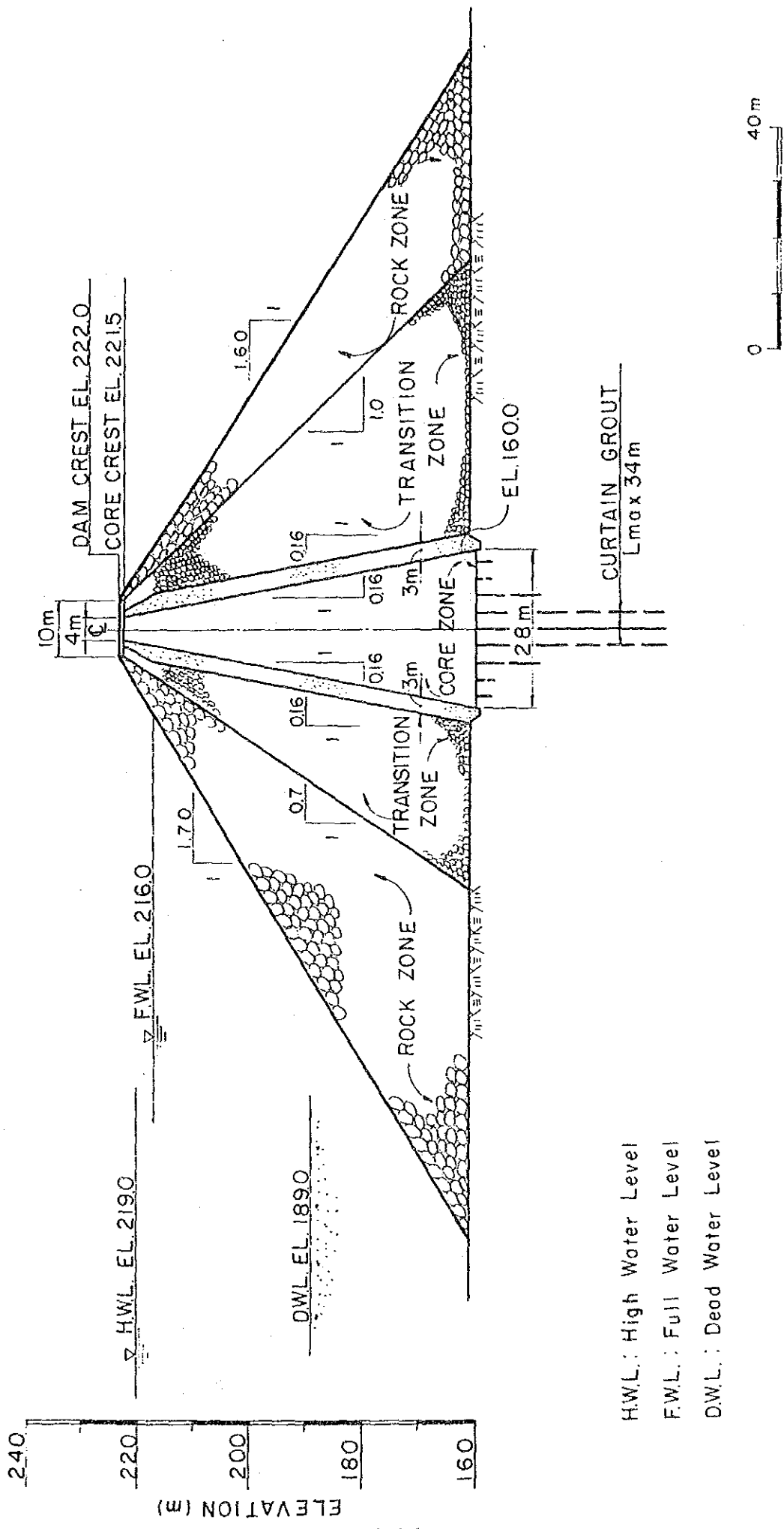
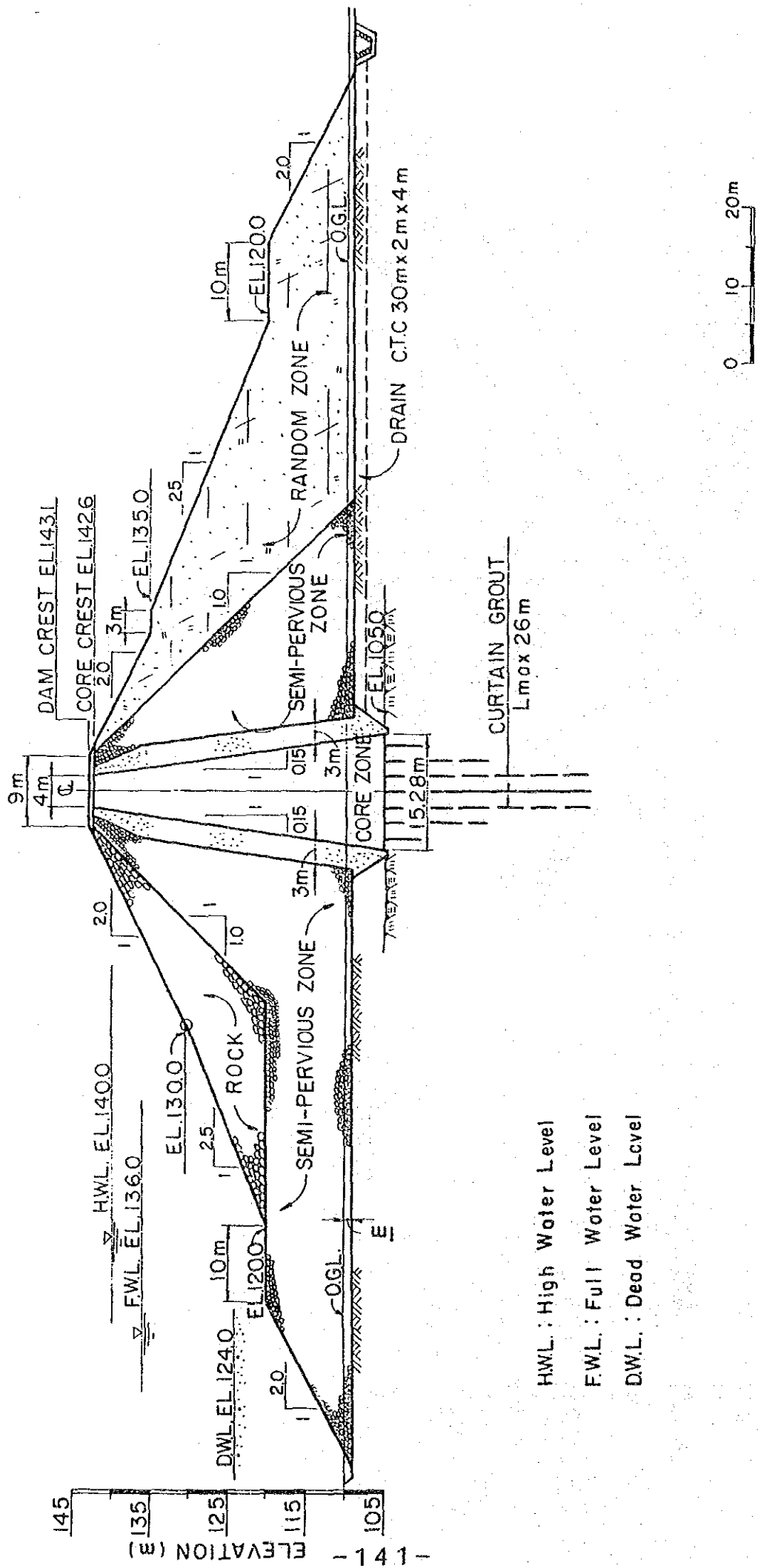


圖 4.7.2 E G A T 電力供給計畫



H.W.L.: High Water Level
 F.W.L.: Full Water Level
 D.W.L.: Dead Water Level

図 5.1.1 ダム標準断面図、アッパーメウオンダム



HWL : High Water Level
 FWL : Full Water Level
 DWL : Dead Water Level



図 5.1.2 ダム標準断面図、ローメウダム

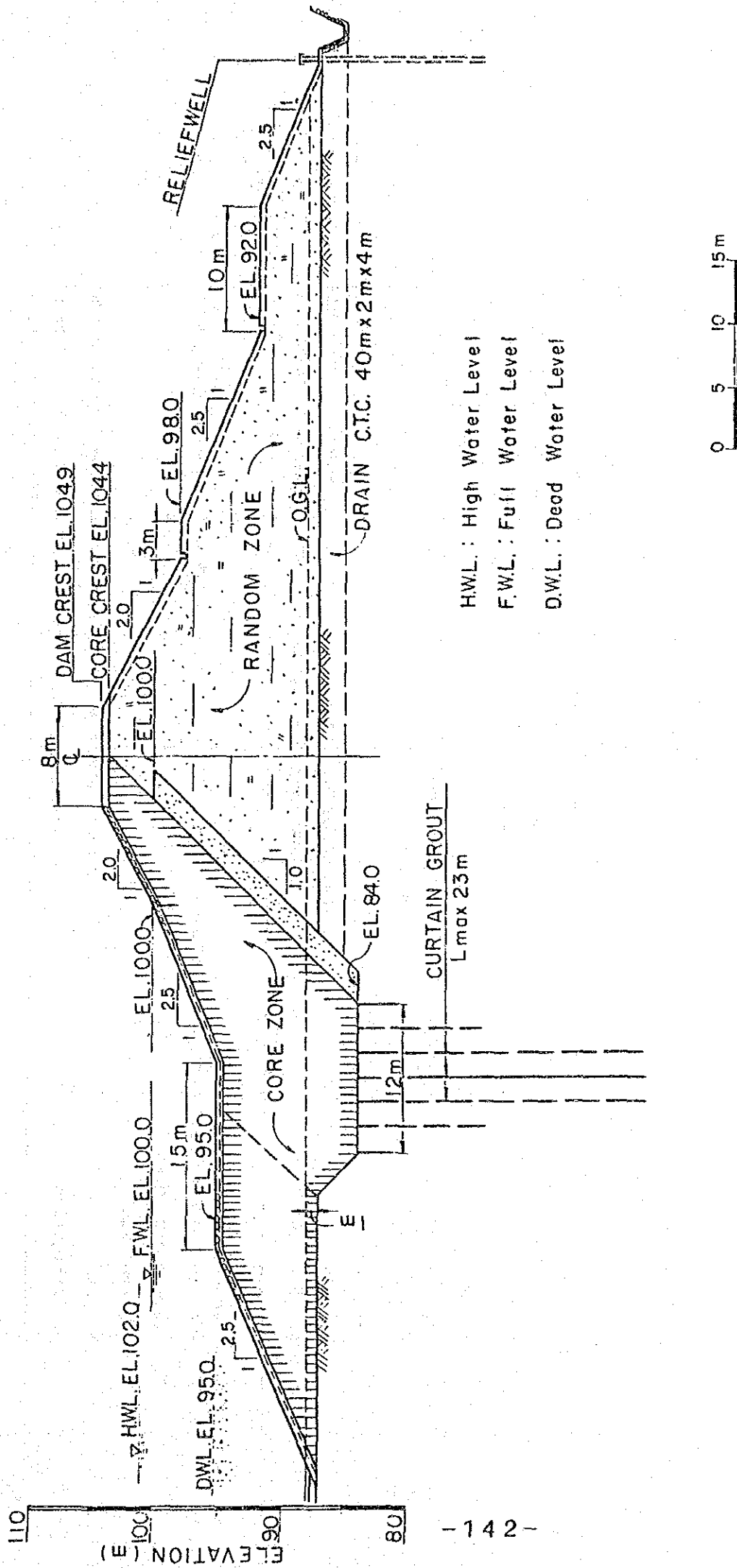


図 5.1.3 ダム標準断面図、クロンポーダム

Item	Year						
	1st	2nd	3rd	4th	5th	6th	7th
<u>1. Upper Mae Wong</u> 1. Engineering Services 2. Preparatory Works 3. Construction a. Dam b. Irrigation							
<u>2. Lower Mae Wong</u> 1. Engineering Services 2. Preparatory Works 3. Construction a. Dam b. Irrigation							
<u>3. Khlong Pho</u> 1. Engineering Services 2. Preparatory Works 3. Construction a. Dam b. Irrigation							

図 5.3.1 優先プロジェクト実施工程図

付 属 資 料

付属資料-1

サカエクラン川流域灌漑計画フィジビリティスタディに関する
スコープオブワーク

SCOPE OF WORK
FOR
FEASIBILITY STUDY
ON
THE SAKAE KRANG RIVER BASIN IRRIGATION PROJECT
IN
THE KINGDOM OF THAILAND

AGREED UPON BETWEEN
ROYAL IRRIGATION DEPARTMENT
AND
THE JAPAN INTERNATIONAL COOPERATION AGENCY

BANGKOK, July 6, 1984

Chari Tulayanond

MR. CHARI TULAYANOND
CHIEF CIVIL ENGINEER
ROYAL IRRIGATION DEPARTMENT
MINISTRY OF AGRICULTURE
AND COOPERATIVES

H. Nakamichi

DR. HIROSHI NAKAMICHI
LEADER OF THE PRELIMINARY
SURVEY TEAM,
THE JAPAN INTERNATIONAL
COOPERATION AGENCY

I. INTRODUCTION

In response to the request of the Government of the Kingdom of Thailand (hereinafter referred to as "the Government"), the Government of Japan decided to implement the feasibility study on the Sakae Krang River Basin Irrigation Project (hereinafter referred to as "the Study"), within the general framework of technical cooperation between Japan and Thailand, which is set forth in the Agreement on Technical Cooperation between the Government of Japan and the Government of the Kingdom of Thailand signed on 5 November 1981.

The Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for the implementation of technical cooperation programs of the Government of Japan, will undertake the Study, in accordance with the relevant laws and regulations in force in Japan and in close cooperation with the authorities of Thailand.

Royal Irrigation Department (hereinafter referred to as "RID") shall act as counterpart agency to the Japanese study team and also as coordinating body to other relevant organizations for the smooth implementation of the Study.

The present document sets forth the Scope of Work for the Study.

II. OBJECTIVES OF THE STUDY

The objectives of the Study are:

1. to review the overall Sakae Krang river basin water resources development plan.
2. to identify the possible projects and recommend the stage of development.
3. to conduct the pre-feasibility study on the potential project(s).
4. to conduct the feasibility study on the first priority project, and
5. to undertake on-the-job training of the government's officials in the course of the Study.

III. OUTLINE OF THE STUDY

1. Study Area

The study area covers the Sakae Krang river basin with a gross area of 7,000 km², which is composed of four sub-basins; the Mae Wong, the Klong Pho, the Thap Salao and the Khok Khwai.

2. Scope of the Study

The activities to be undertaken by the Team will be divided into two stages as follows:

- (1) Pre-Feasibility Study; to conduct the overall river basin development study on the Sakae Krang river basin (Part-A) and the pre-feasibility study on the project(s) to be selected in the Part-A study (Part-B).
- (2) Feasibility Study; to conduct the feasibility study on the project to be selected in the pre-feasibility study (Part-C).

2.1 Work Plan for the Pre-Feasibility Study

The study will cover the following items:

Part-A

- (1) To review all existing and proposed irrigation projects in the basin.
- (2) To evaluate the agricultural land and water resources (surface water and groundwater) and identify the possible reservoirs and other water uses.
- (3) To study the basic concept for the plan of agricultural development and formulate possible irrigation projects.
- (4) To identify the possible project and recommend the implementation schedule of basin development, and select the project(s) to be studied at pre-feasibility level.
- (5) To study the environmental impact and recommend water and/or soil conservation
- (6) To determine the hydropower development potential in the basin. Detail study should be carried out by others.

Part-B

- (1) To collect and review the relevant existing data and information including;
 - a. Topography
 - b. Meteorology
 - c. Hydrology
 - d. Geology and Hydrogeology
 - e. Soil
 - f. Irrigation and Drainage
 - g. Agriculture
 - h. Agro and regional economy and institution
 - i. Flood control
 - j. Others

- (2) To survey in the project area including;
 - a. Topographical survey
 - b. Meteorological survey
 - c. Hydrological survey
 - d. Agricultural survey
 - e. Socio-economic survey
 - f. Regional economic and agro-institutional survey
 - g. Flood control survey
 - h. Construction material and cost survey
 - i. Other survey including resettlement
- (3) To formulate the development plan and estimate all project requirements at the pre-feasibility level.
- (4) To identify the project priority taking into account of the technical and economic feasibility as well as the social elements involved in each projects and select the project to be studied at the feasibility study level.
- (5) To recommend and suggest the further study or measures to be undertaken based on the results obtained from the pre-feasibility study.

2.2 Work Plan for the Feasibility Study

Part-C

Based on the results of the pre-feasibility study, the study will cover the following items:

- (1) Additional field survey and data collection including;
 - a. Soil and land classification survey
 - b. Geological survey
 - c. Groundwater survey
 - d. Others
- (2) Determination of the basic items for the project planning in the field works including;
 - a. Project area
 - b. Land use and cropping pattern
 - c. Water requirements
 - d. Dam planning and design in view of irrigation, flood control, hydro-power development potential and other potential water uses

- e. Irrigation and drainage canal networks and facilities
 - f. Estimation of yields
 - g. Agro-institutional plan
 - h. Social-institutional services
 - i. Others
- (3) Formulation of the integrated development plan for the project
 - (4) Preliminary design of the major structure of the project
 - (5) Preparation of the implementation schedule
 - (6) Estimation of the project costs and benefits
 - (7) Evaluation of the project
 - (8) Operation and maintenance
 - (9) Recommendation

IV. WORK SCHEDULE

The Study will be executed in accordance with the attached tentative working schedule.

V. REPORTS

JICA will prepare and submit following reports in English to the Government:

- 1. Plan of Operation
Twenty (20) copies at the commencement of the pre-feasibility study and the feasibility study.
- 2. Progress Report
Twenty (20) copies at the end of the field works of the pre-feasibility study.
- 3. Pre-Feasibility Study Report
Fifty (50) copies at the end of the pre-feasibility study.
- 4. Interim Report
Fifty (50) copies at the end of the field works of the feasibility study.

5. Draft Final Feasibility Study Report

Fifty (50) copies within one (1) month after the end of the feasibility study.

The Government is requested to provide its comments on the Draft Final Report to JICA through JICA office in Bangkok within one (1) month after the submission of the Draft Final Report.

6. Final Feasibility Study Report

Hundred (100) copies within two (2) months after receiving the comments of the Government on the Draft Final Report.

VI. UNDERTAKING OF THE GOVERNMENT OF THE KINGDOM OF THAILAND

1. In accordance with the Agreement on Technical Cooperation between the Government of Japan and the Government of the Kingdom of Thailand, the Government of the Kingdom of Thailand shall accord benefits to the Japanese study team and, through the authorities concerned, take necessary measures to facilitate the smooth implementation of the Study.

2. RID shall make necessary arrangements with the cooperation of other relevant organizations for the followings:

(1) to secure the safety of the Study team,

(2) to permit the members of the Japanese study team to enter, leave and sojourn in Thailand for the duration of their assignment therein, and exempt them from alien registration requirements and consular fees,

(3) to exempt the members of the Japanese study team from income tax and other fiscal charge imposed on or in connection with any emolument or allowance paid to the members of the Japanese study team for their services in connection with the implementation of the Study.

(4) to facilitate medical services as needed, its expenses will be chargeable on the member of the Japanese study team,

(5) to secure permission within its authority to take available data and documents related to the Study out of Thailand to Japan by the Study team.

3. RID shall, at its own expense, provide the Japanese study team with the followings, in cooperation with other relevant organizations:

(1) available data and information related to the Study,

- (2) topographical survey, for the first priority project (by the beginning of the feasibility study),
 - a. topographical maps
 - dam sites ; scale of 1/1,000
 - reservoir areas ; scale of 1/4,000
 - irrigation areas; scale of 1/10,000
 - resettlement areas; scale of 1/4,000
 - b. cross and vertical sectional survey
 - c. topographical maps of borrow areas for embankment material
- (3) geological and soil mechanical survey, for the first priority project (by the beginning of the feasibility study),
 - a. geological and soil mechanical survey
 - b. sampling and laboratory investigation of the embankment material
- (4) land acquisition and compensation,
 - a. survey of affected households, lands and public facilities in the proposed reservoir area
- (5) additional surveys related to the feasibility study if necessary,
- (6) counterpart personnel as follows,
 - a. General Planning Engineer
 - b. Irrigation and Drainage Engineer
 - c. Geologist and Hydrogeologist
 - d. Hydrologist
 - e. Soil Mechanical Engineer
 - f. Soil Scientist
 - g. Agronomist
 - h. Agro-economist
 - i. Agro-institutional Specialist
 - j. Dam Engineer
 - k. Construction Planning & Cost Engineer
 - l. Environmental Specialist
 - m. Survey Engineer

The number of counterpart personnel and their respective assignment should be decided by RID in consultation with the study team,

- (7) suitable office space with necessary equipment in Bangkok and project site,
 - (8) appropriate number of vehicles with driver in the project area,
 - (9) credentials or identification cards.
4. The Government of Kingdom of Thailand shall bear claims, if any arises against the members of the Japanese study team resulting from, occurring in the course of, or otherwise connected with the discharge of their duties in the implementation of the Study, except when such claims arise from gross negligence or willful misconduct on the part of the members of the Japanese study team.

VII. UNDERTAKING OF THE GOVERNMENT OF JAPAN

For the implementation of the Study, the Government of Japan shall, in accordance with the relevant laws and regulations in force in Japan, take the following measures through JICA:

1. to dispatch, at its own expense, study teams to Thailand,
2. to perform technology transfer to the Thai counterpart personnel in the course of the Study.

VIII. JICA and RID will consult with each other in respect of any matter that is not agreed upon in this document and may arise from or in connection with the study.

Tentative Working Schedule for the Feasibility Study

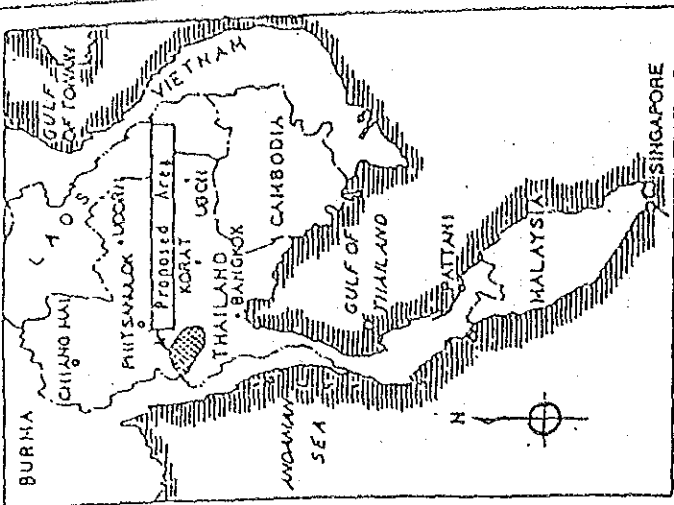
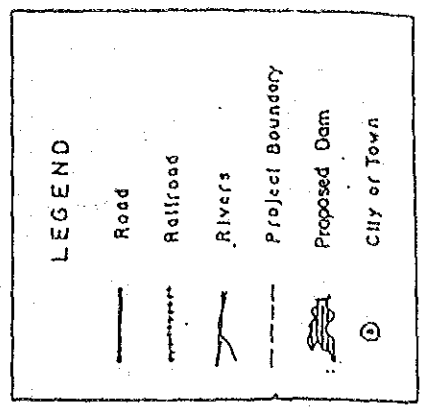
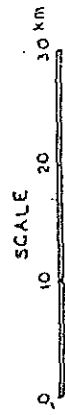
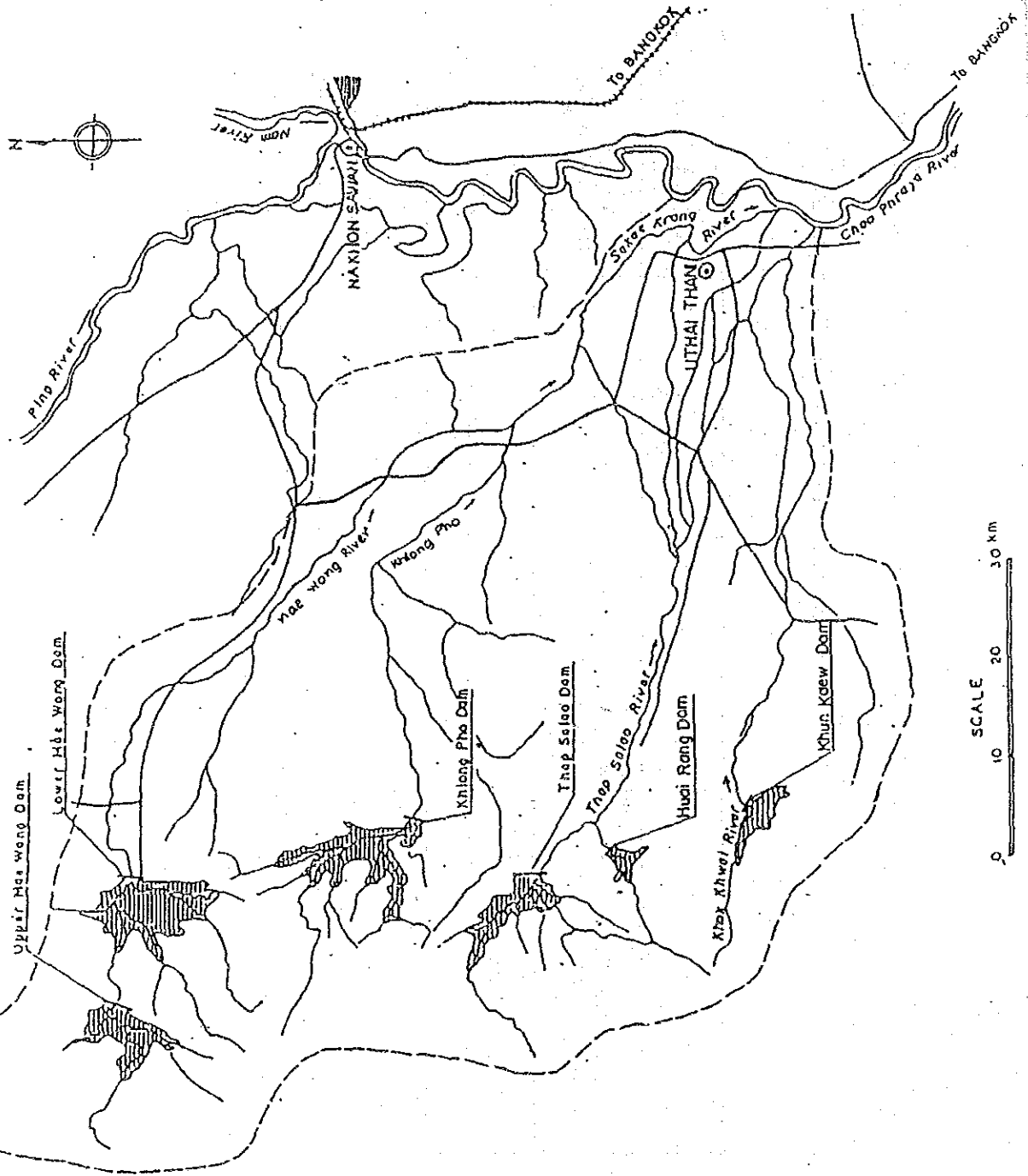
on

The Sakae Krang River Basin Irrigation Project

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Field and Office work in TH.		▨ (Part-A)	▨ (Part-B)				▨			▨	▨	▨				▨			
Office Work in Japan					▨	▨	▨						▨						
Submission of Reports	△ P.O.			△ P.R.			△ P.R.2			△ P.O.		△ I.R.				△ D.R.			△ F.R.
Remarks	Pre-Feasibility Study (Part-A, Part-B)											Feasibility Study (Part-C)							

- P.O. 1 Plan of Operation
- P.R. 1 Progress Report
- P.R. 2 Pre-Feasibility Study Report
- I.R. Interim Report
- D.R. Draft Final Feasibility Study Report
- F.R. Final Feasibility Study Report

GENERAL MAP FOR THE SAKAE KRANG
RIVER BASIN IRRIGATION PROJECT



付屬資料-2

作業監理委員 タイ国政府関係者・調査団員名簿

A. 作業監理委員

- | | | | |
|-----------|--------|----------|-------------|
| (1) 中道宏 | 総括 | 農水省構造改善局 | 建設部設計課 |
| | | 農業土木専門官 | |
| (2) 亀田昌彦 | 灌溉・排水 | 農水省構造改善局 | 建設部設計課 |
| | | 農業土木専門官 | |
| (3) 木下湧二郎 | 栽培・土壌 | 東海農政局 | 計画部資源課 |
| | | 課長補佐 | |
| (4) 藤沼敏雄 | 経済評価 | 海外経済協力基金 | 業務第1部 業務第1課 |
| | | 課長代理 | |
| (5) 国安法夫 | JICA担当 | 国際協力事業団 | 農林水産計画調査部 |
| | | 農林水産技術課 | |

B. RID職員

- | | |
|------------------------------|---|
| (1) Mr. Suthep Tingsabhat | Chief Engineer of Civil Engineering |
| (2) Dr. Boonyok Wadhanaphuti | Director, Project Planning Division |
| (3) Mr. Shoombhol Chaveesuk | Director of Design Division |
| (4) Mr. Suthi Songvoravit | Chief of Policy Branch, Project Planning Division |
| (5) Mr. Ruongrit Ammawat | Design Division |
| (6) Mrs. Nophakhun Somsin | Hydrology Division |
| (7) Mr. Taweechai Mackaman | Hydrology Division |
| (8) Mr. Klaus Lindner | Advisor, Project Planning Division |
| (9) Mr. Kaiwan Devahasdin | Program Co-ordination & Budget Division |

- | | |
|--------------------------------|--|
| (10) Mr. Virat Khao-Uppatum | O & M Division |
| (11) Mr. Osot Charnvej | Agronomist, O & M Division |
| (12) Mr. Vira Poomvises | Geo-technic Division |
| (13) Mr. Maitri Poolsup | Civil Engineer, Design Division |
| (14) Mr. Jumsak Tejasen | Director, Research & Laboratory
Division |
| (15) Mr. Prasert Milintangul | Chief of Research & Applied Division |
| (16) Mr. Saguan Jamprawit | Chief of Soil and Geology Division |
| (17) Mr. Silpachai Niyomsilpa | Director of Topographical Division |
| (18) Mr. Sompoch Pimonpun | Chief of Ground Survey Sub-Division |
| (19) Mrs. Supha Sing Intara | Chief of Economic Branch, Project
Planning Division |
| (20) Mr. Supote Rujikakul | Engineer, Project Planning Division |
| (21) Mr. Roungrit Ammawat | Chief of Engineer, Dam Design
Sub-Division |
| (22) Mr. Prasart Chuntrniyom | Director of Irrigation Region 7 |
| (23) Mr. Chalermorn Phirunsarn | Civil Engineer, Region 7 |
| (24) Mr. Seni Wichitsiri | Civil Engineer, Region 7 |
| (25) Mr. Sompoch Pimonpun | Topographical Survey |
| (26) Mr. Preecha Chotesangasa | Topographical survey |
| (27) Mr. Chaityuth Suksri | Project Planning Division |
| (28) Mr. Suwit Thanopanuwat | Project Planning Division |
| (29) Mr. Prateep Kanchanalarb | Engineer, Project Planning Division |
| (30) Mr. Akkapong Boonmash | Civil Engineer, O & M Division |
| (31) Mr. Toshiki Saito | Colombo Plan Expert, Project
Planning Division |
| (32) Mr. Katsuro Shioda | Colombo Plan Expert, O & M Division |
| (33) Mr. Fumio Ikeda | Colombo Plan Expert, Design Division |

C. 地方行政職員

NAKHON SAWAN PROVINCE

- | | |
|-------------------------------|---------------------------------------|
| (1) Mr. Prakrit Pinchareon | Governor |
| (2) Mr. Yuthana Buanwong | Deputy Governor |
| (3) Mr. Boonyun Supasansatorn | Officer of Lat Yao District |
| (4) Mr. Watana Lertdhamtavi | Assistant Officer of Lat Yao District |

UTHA THANI PROVINCE

- | | |
|------------------------------|-----------------|
| (5) Mr. Yong Pakdee | Governor |
| (6) Mr. Sangad Chan-Chanchoy | Vice Governor |
| (7) Mr. Precha Sirikawin | Deputy Governor |

D. 調査団員

- (1) 坂 本 正 総 括 (団長)
- (2) 山 崎 隆 可 農 業 / 農 業 經 済 (副 団 長)
- (3) 秋 月 勲 灌 漑 排 水 計 画
- (4) 大 堀 正 至 夕 々 計 画
- (5) 辻 秀 夫 水 文
- (6) 磯 貝 洋 尚 地 質 ・ 土 質
- (7) 有 賀 直 記 土 壤
- (8) 佐 藤 英 男 発 電 計 画
- (9) 大 庭 孝 夫 環 境 評 価
- (10) 畔 上 重 春 構 造 物 設 計

MINUTES OF MEETING
OF
THE SCOPE OF WORK FOR THE FEASIBILITY STUDY
ON
THE SAKAE KRANG RIVER BASIN IRRIGATION PROJECT
IN
THE KINGDOM OF THAILAND

1. In response to the request of the Government of the Kingdom of Thailand, the Government of Japan has dispatched a Preliminary Survey Team for the feasibility study on the Sakae Krang River Basin Irrigation Project from 25th June to 7th July 1984, through the Japan International Cooperation Agency (JICA), the official agency responsible for the Government of Japan.
2. The Preliminary Survey Team headed by Dr. Hiroshi Nakamichi, Chief Engineer, Construction Department, Agricultural Structure Improvement Bureau, Ministry of Agriculture, Forestry and Fisheries, and the Thai officials concerned headed by Mr. Chari Tulayanond, Chief Civil Engineer, Royal Irrigation Department, Ministry of Agriculture & Cooperatives, had a series of discussion and exchanged their views in the field and also in the head office on the Scope of Work for the feasibility study prepared by JICA through collecting first-hand information regarding the project. As a result of the discussions, both sides have agreed on the Scope of Work.

3. Both sides have agreed the followings:

- (1) The geological survey of the alternative dam sites at the pre-feasibility study level would be carried out by Royal-Irrigation Development (RID).
- (2) The office work of the Japanese study team in Thailand should be conducted in cooperation with RID officials by making the best use of the Irrigation Engineering Center which is going to be set up, so as to perform technology transfer to the counterpart personnel in the course of the study.

4. The Thai side strongly requested to the Japanese survey team:

- (1) To prepare and submit a set of microfilm of the Final Feasibility Study Report.
- (2) To recommend the terms of reference for design phase in the feasibility study.

BANGKOK, JULY 6, 1984

Chari Tulayanond

MR. CHARI TULAYANOND
CHIEF CIVIL ENGINEER
ROYAL IRRIGATION DEPARTMENT
MINISTRY OF AGRICULTURE &
COOPERATIVES

H. Nakamichi

DR. HIROSHI NAKAMICHI
LEADER OF THE PRELIMINARY
SURVEY TEAM,
THE JAPAN INTERNATIONAL
COOPERATION AGENCY

MINUTES OF MEETING

FOR

THE PLAN OF OPERATION

ON

THE SAKAE KRANG REVER BASIN IRRIGATION PROJECT

Date : October 8, 1984

Place : Conference Room in RID

Attendance : Attached Paper 1

In accordance with "SCOPE OF WORK FOR FEASIBILITY STUDY ON THE SAKAE KRANG RIVER BASIN IRRIGATION PROJECT IN THE KINGDOM OF THAILAND" agreed on July 6, 1984 between the Japan International Cooperation Agency (JICA) and the Royal Irrigation Department (RID), JICA dispatched the Study Team (the Team) and the meeting was held for discussion on the Plan of Operation prepared by the Team. Both sides have mutually agreed as follows:

1. Explanation on the Plan of Operation was made by the Team and it was generally accepted by RID,
2. RID suggested the Team to execute many alternative studies for selection of the high priority project (s),
3. Priority ranking of the project (s) will be made based on not only the results of economic analysis but also the results of social and environmental studies,
4. The Team will carry out the pre-feasibility study excluding the Thap Salao Dam Project as its study has been completed. However, the overall river basin water balance study will be carried out including the Thap Salao Dam Project,
5. According to the "Tentative Working Schedule" attached in the "Scope OF WORK" RID will carry out the surveys as specified in Chapter IV, (7) a, (7) b, (7) c, (8) and (9) in the "Plan of Operation" within two (2) months prior to the commencement of Part C Study (Feasibility Study).

In order to secure the completion of above survey by RID in time, the Team will make efforts to prepare the scope of surveys in the Progress Report which will be submitted to RID at the end of December 1984, and

6. Request from RID on a set of microfilm of the Final Feasibility Study Report was reconfirmed and the request will be informed to the Advisory Committee Mission of JICA when the mission will be dispatched in the middle of December 1984.

BANGKOK, OCTOBER 9, 1984

Chari Tulayanond

MR. CHARI TULAYANOND
DEPUTY DIRECTOR GENERAL FOR CONSTRUCTION
ROYAL IRRIGATION DEPARTMENT
MINISTRY OF AGRICULTURE &
COOPERATIVES

T. Sakamoto

MR. TADASHI SAKAMOTO
TEAM LEADER OF THE
STUDY TEAM FOR THE
SAKAE KRANG RIVER BASIN
IRRIGATION PROJECT

<u>NAME OF ATTENDANTS</u>	<u>POSITION</u>
1. MR. SHOOMBHOL. CHAVEESUK	Director of Design Division
2. MR. SUTHI SONGVORAVIT	Chief of Policy Branch, Project Planning Div.
3. MR. JUMSAK TEJASEN	Director of Research & Lab., Div.
4. MR. PRASERT MILINTANGUL	Chief of Research & Applied, Div.
5. MR. SAGUAN JAMPRAWIT	Chief of Soil and Geology, Div.
6. MR. SILPACHAI NIYOMSILPA	Director of Topographical, Div.
7. MR. SOMPOCH PIMONPUN	Chief of Ground Survey, Sub-Division
8. MS. SUPHA SING INTARA	Chief of Economic Branch, Project Planning Div.
9. MR. SUPOTE RUJIRAKUL	Engineer, Project Planning Div.
10. MR. MAITRI POOLSUP	Civil Engineer, Design Div.
11. MR. ROUNGRIT AMMAWAT	Chief of Engineer Dam Design, Sub-Division
12. MR. TOSHIKI SAITO	JICA, Attached, Project Planning Div.
13. MR. PRASART CHUNTRNIYOM	Director of Irrigation Region 7
14. MR. CHALERMPORN PHIRUNSARN	Civil Engineer, Region 7
15. MR. SUWIT THANOPANUWAT	Civil Engineer, Project Planning Div.
16. MR. PRATEEP KANCHANALARB	Engineer, Project Planning Div.
17. MR. AKKAPONG BOONMASH	Civil Engineer, O & M Div.
18. MR. TADASHI SAKAMOTO	Team Leader
19. MR. TAKAYOSHI YAMAZAKI	Agronomist/Agro-Economist (Co-Team Leader)
20. MR. ISAO AKIZUKI	Irrigation & Drainage Engineer
21. MR. TADASHI OHORI	Dam Engineer
22. MR. HIDEO TSUJI	Hydrologist

MINUTES OF MEETING
FOR
DRAFT PROGRESS REPORT
ON
FEASIBILITY STUDY
FOR
THE SAKAE KRANG RIVER BASIN IRRIGATION PROJECT

1. Date : December 13, 1984
2. Time : 2:00 - 3:30 P.M.
3. Place : RID Conference Room
4. Attendants : See Attached List
5. Summary of Discussion

The Chairman, Mr. Suthep Tingsabhat, Chief Engineer of Civil Engineering RID introduced Dr. Hiroshi Nakamichi, Chairman of JICA advisory committee and Mr. Tadashi Sakamoto, Leader of JICA Study Team, to the attendants. Dr. H. Nakamichi explained the present work progress and made a remark that the study is now in progress as scheduled.

Mr. T. Sakamoto explained the outline of the progress report, following the summary of the draft report and supplementary note No. 1 and No. 2 which dealt with results of reservoir operation study and selection of high priority projects. He pointed out that the high priority projects should be selected through the discussion as the study team would leave for Japan to carry out the pre-feasibility study on high priority projects. The Chairman asked the attendants to make comments and suggestions on the report and notes, and several discussions were made between RID representatives and JICA study team. The followings were mutually confirmed through discussions:

- (1) High priority projects would be Upper Mae Wong, Lower Mae Wong and Khlong Pho projects.
- (2) Detailed technical discussions will be made for confirmation on the above selection of high priority projects. Selection of the first priority project will also be discussed. RID would make an arrangement of such technical meetings.

- (3) JICA study team agreed, on the request from RID, that the following alternative studies would be made in Part B programme:
- a. water balance studies for different cropping intensities, and
 - b. project alternative studies for irrigation development under two different development strategies; i.e.,
 - i. irrigation development with moderate investment on existing facilities for more effective use of water, and
 - ii. irrigation development with minor investment on existing facilities for minimizing the project costs.
- (4) For irrigation development, the first priority should be given to the existing irrigation areas.
- (5) Groundwater exploitation should be considered for future stage of development.

Suthep Tingsabhat.

Suthep Tingsabhat
Chief Engineer of Civil Engineering
Royal Irrigation Department

T. Sakamoto

Tadashi SAKAMOTO
Leader of JICA
Study Team

LIST OF ATTENDANTS

1.	Mr. Suthep Tingsabhat	Chief Engineer of Civil Engineering
2.	Dr. Boonyok Wadhanaphuti	Director, Project Planning Division
3.	Mr. Shoombhol Chaveesuk	Director of Design Division
4.	Mr. Ruongrit Ammawat	Design Division
5.	Mrs. Nophakhun Somsin	Hydrology Division
6.	Mr. Taweechai Mackaman	Hydrology Division
7.	Mr. Klaus Lindner	Advisor, Project Planning Division
8.	Mr. Toshiki Saito	Colombo Plan Expert, Project Planning Division
9.	Mr. Katsuro Shioda	Colombo Plan Expert, O & M Division
10.	Mr. Fumio Ikeda	Colombo Plan Expert, Design Division
11.	Mr. Kaiwan Devahasdin	Program Co-ordination & Budget Division
12.	Mr. Virat Khao-Uppatum	O & M Division
13.	Mr. Osot Charnvej	Agronomist, O & M Division
14.	Mr. Vira Poomvises	Geo-technic Division
15.	Mr. Maitri Poolsup	Civil Engineer, Design Division
16.	Mr. Jumsak Tejasen	Director, Research & Laboratory Division
17.	Mr. Supote Rujirakul	Engineer, Project Planning Division
18.	Mr. Chalernporh Phirunsarn	Civil Engineer; Region 7
19.	Mr. Sompoch Pimonpun	Topographical Survey
20.	Mr. Preecha Chotesangasa	Topographical Survey
21.	Mr. Chaiyuth Suksri	Project Planning Division
22.	Mr. Suwit Thanopannwat	Project Planning Division
23.	Dr. Nakamichi Horoshi	Chief Irrigation Engineer, MAFF
24.	Mr. Norio Kuniyasu	Technical Affairs Division, JICA
25.	Mr. Tadashi Sakamoto	Team leader of Sakae Krang F/S team (JICA)
26.	Mr. Takayoshi Yamazaki	Member of Sakae Krang F/S team (JICA)
27.	Mr. Isao Akizuki	Member of Sakae Krang F/S team (JICA)
28.	Mr. Tadashi Otori	Member of Sakae Krang F/S team (JICA)
29.	Mr. Naoki Ariga	Member of Sakae Krang F/S team (JICA)
30.	Mr. Hideo Sato	Member of Sakae Krang F/S team (JICA)

Assignment Schedule of part A and Part B

Position	Name	1984					1985		
		Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
Team Leader	Tadashi Sakamoto			■		■		□	■
Agronomist/Agro-Economist (Co-Team Leader)	Takayoshi Yamazaki			■	■	■	■	■	■
Irrigation & Drainage Engineer	Isao Akizuki			■	■	■	■	■	■
Dam Engineer	Tadashi Ohori			■	■	■	■	■	■
Hydrologist	Hideo Tsuji			■	■	■	■	■	■
Geologist/Soil Mechanical Engineer	Hirohisa Isogai			■	■	■	■	■	■
Pedologist	Naoki Ariga			■	■	■	■	■	■
Hydropower Engineer	Hideo Sato				■	■	■	■	■
Environmental Specialist	Takao Ohba			■	■	■	■	■	■
Design Engineer	Shigeharu Azegami			■	■	■	■	■	■
Reports			▲ Plan of Operation		▲ Progress Report				▲ Pre-Feasi- bility Study Report

■ : Field Work

□ : Home Work

付属資料-4

アッパーメウオンプロジェクトに対する追加調査仕様書

1. Irrigation and Drainage

(1) Topographic survey for irrigable area

The available topographic maps on a scale of 1 to 10,000 with contour interval of 1.0 m cover only a part of irrigable area in the Mae Wong river basin to be developed under the project (see Fig. 1.1). The following topographic maps which cover the existing irrigation areas and potential areas to be improved and developed under the project, should be additionally prepared by the topographic survey for the feasibility study on the Upper Mae Wong Project.

<u>Scale</u>	<u>Contour Interval</u>	<u>Covering Area</u>
1 : 10,000	1 m	554 km ²

(2) Investigation on water use of existing irrigation area

Since no actual records on diversion water to the existing irrigation areas were available, the water amount used for the existing irrigation areas was estimated through the present water balance calculation. In order to confirm and check the results of above calculation in the feasibility stage, an investigation on water use of existing irrigation areas will be required. For such investigation, the staff gauges should be installed at the main diversion points of the Mae Wong river to observe the water level. The location of staff gauges to be installed is shown in Fig. 1.2. The water level should be recorded two times per day at each staff gauge. As for the Khun Lard Boriban and Wang Ma staff gauges, the opening of gates should also be recorded at the same time.

2. Dam and Reservoir Survey

(1) Topographic Survey

(a) Plane survey for reservoir area (Fig. 2.1)

scale : 1/10,000
contour interval : 2 m
area : 60 km²

(b) Plane survey for dam site area (Fig. 2.2)

scale : 1/1,000
contour interval : 1 m
area : 10 km²

(c) Longitudinal survey of dam axis (Fig. 2.3)

length : 1,400 m
scale : 1/500

(d) Cross section survey

(i) Dam axis cross section (Fig. 2.3)

length : 400 m/line
number of section : 13
scale : 1/500

(ii) River cross section (Fig. 2.1)

length : 500 m/line
number of section : 9, 1 km interval
scale : 1/500

(2) Geological Survey

(a) Seismic sounding (Fig. 2.4, Fig. 2.5)

<u>Site</u>	<u>Line</u>	<u>Length (m)</u>
Damsite		
dam axis	A	1,400
cross section	B	1,000
	C	1,000
	D	1,000
Spillway	E	1,000
Borrow area	F	750
	G	500
Total		6,650

(b) Core boring (Fig. 2.4, Fig. 2.5)

<u>Site</u>	<u>No.</u>	<u>Diameter</u> (mm)	<u>Depth</u> (m)	<u>Core tube</u>	<u>Permeability test</u>
Dam site	B1	ø65	40	double	5 m interval
	B2	ø65	50	"	"
	B3	ø65	60	"	"
	B4	ø65	60	"	"
	B5	ø65	60	"	"
	B6	ø65	30	"	"
	B7	ø65	30	"	"
Spillway	B8	ø65	30	"	"
Borrow area	B9	ø65	20	"	"
	B10	ø65	20	"	"
	B11	ø86	10	single	"
	B12	ø86	10	"	"
	B13	ø86	10	"	"
	Total			430 m	

- Note:
1. Ground water level should be recorded on the geological log of boring hole.
 2. Location of boring hole should be shown on the 1/10,000 scale topographic map.
 3. Ground surface elevation of boring hole should be surveyed.
 4. Wooden pegs to show the location of boring holes and seismic sounding lines should be installed.
 5. Boring core should be kept in core box and color photo should be attached on the log.
 6. Boring at dam site (B1 to B7) can be terminated after drilling depth exceeded more than 30 m upon approval of Engineer of the Soil and Geology Division, but one drilling hole among B4, B5 and B6 should complete 60 m in depth.

(3) Material Test

(a) Rock materials

(i) Sampling from exposed rocks

Sampling place : Damsite left and right abutments, vicinity of B8, B9 and B10 boring holes.

Sampling number : 3 samples from granite rocks
3 samples from quartzite rocks

(ii) Test items

- absorption test
- specific gravity
(surface dry, inside satulate)
- durability test

(b) River Sand

(i) Distribution

- auger hole borings to confirm the depth of river sand deposit
- distribution width of river sand be measured by tape measurements

(ii) Sampling

upstream of dam	3 samples
dam axis	1 sample
downstream of dam	3 samples

(iii) Test items

- gradation test 7 samples
- specific gravity 7 samples
- compaction test 7 samples

(c) Core Material

(i) Core boring B11, B12, B13

(ii) Test pitting (Fig. 2.4)

- Location shown in Fig. 2.4
- Number of test pit 7 (TP1-TP7)
- Dimension of test pit

Width	2.0 x 2.0 m square
Depth	6 m max.

- Investigation

Log of test pit should be prepared.
Colour photo should be attached on the log.

(iii) Material test (1)

Sampling

2 samples per test pit, Total 14 samples.
Sampling locations should be upon approval of Engineer and shown on the test pit log.

Test items

- field moisture content
- consistency test
- gradation test
- specific gravity test for two groups
 - d min 4.76 mm
 - d max 4.76 mm
- compaction test
 - d max less than 4.76 mm
- dipressive soil test

(iv) Material test (2)

- Sampling

Three samples out of 7 test pits,
50 kg/pit

Selection of samples from 7 test pits should be instructed by the Engineer of the Soil and Geological Division. Sampling operation should be coordinated with the laboratory test schedule in order to avoid unnecessary stock and waiting which may affect the samples quality.

- Test item

- tri-axial test

- o consolidated, saturated and undrained conditions
- o pressure level

= 0.5 kg/cm², 1.0 kg/cm²,
2.0 kg/cm², 3.0 kg/cm²
and if possible 4 kg/cm²

- o shearing speed

V = less than 1% per one minute

- o test sample

Diameter 5 cm or 2 inches or 1.5 inches
Height Diameter x 2
d max. 4.76 cm

- o test point

The test points of tri-axial test are point 1, 3 and 4 in the Figure illustrated in next page.

- o Total test samples

3 samples x 4 pressure levels x 3 points = 36

- Consolidation test

◦ load level

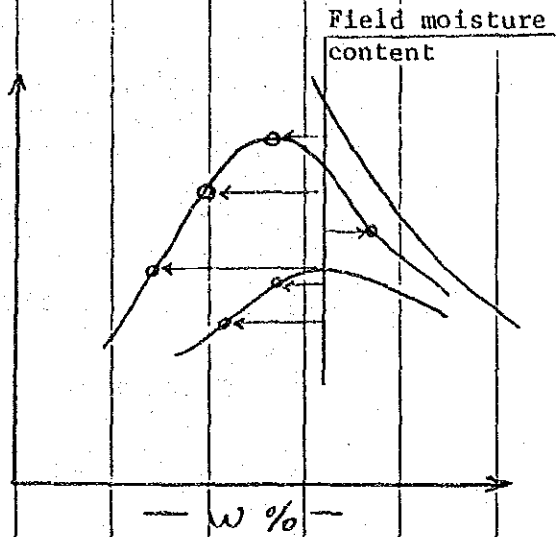
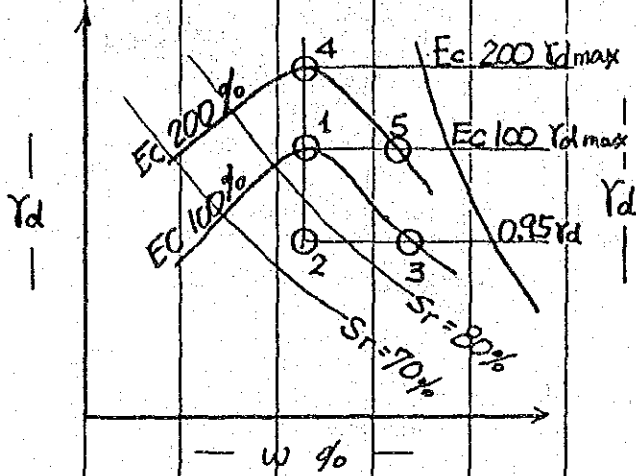
0.1, 0.2, 0.4, 0.8, 1.6, 3.2, 6.4
and 12.8 kg/cm²

- Permeability test

variable head permeability test

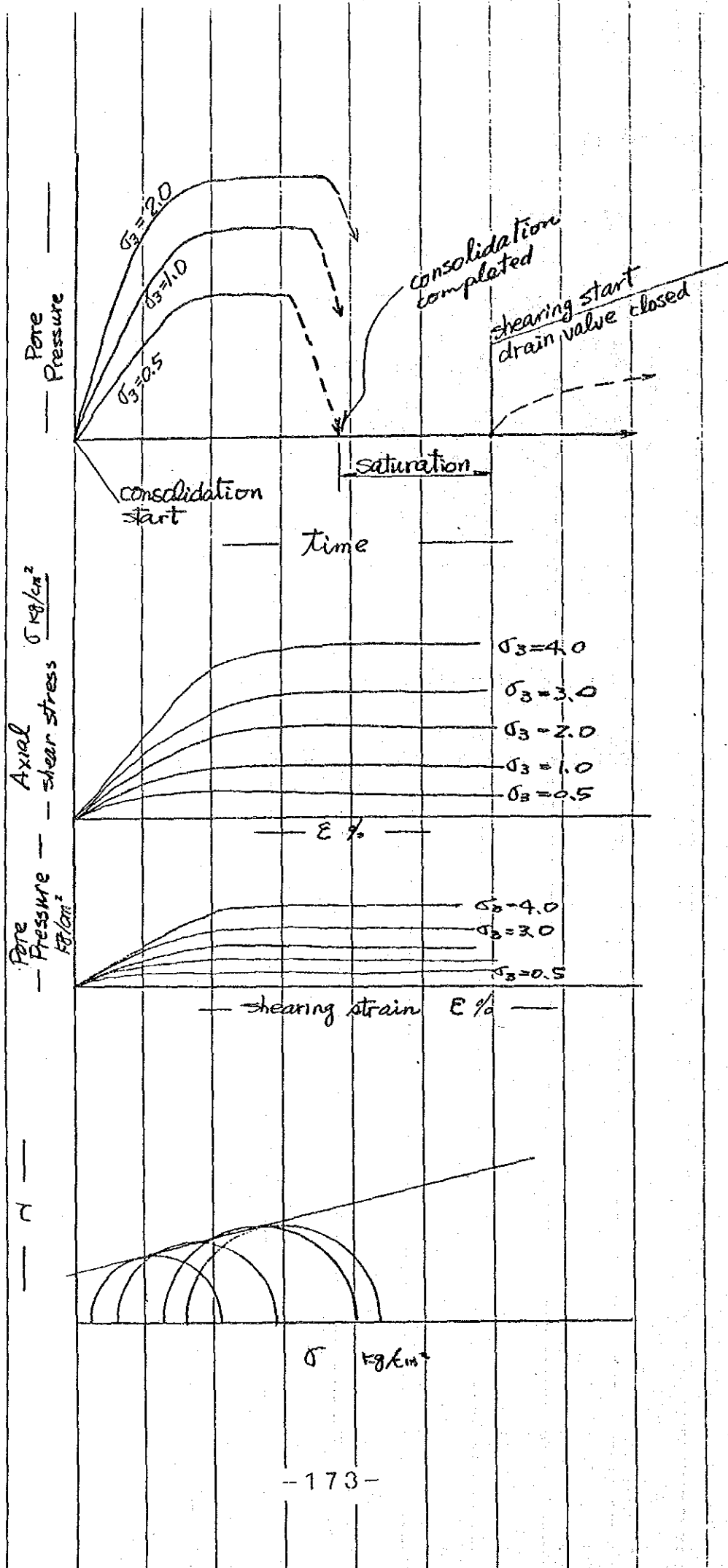
c. Test point

○ : Test Point



Adjustment of moisture content should be started from the field moisture content.

Adjustment of moisture content by means of, once dried and adding water should not be allowed.



3. Soil Survey

(1) Field Soil Survey

- (a) Soil profile survey over the first priority project area
- (b) Soil sampling; This will be required for laboratory test
- (c) Soil infiltration test on representative soils

(2) Soil Laboratory Tests

The following soil laboratory tests are required:

- pH (H₂O) & pH (KCl)
- electrical conductivity
- total carbon
- total nitrogen
- exchangeable bases (Ca, Mg, K, Na)
- cation exchangeable capacity
- available phosphorus
- total potassium
- calcium carbonate
- particle size distribution analysis

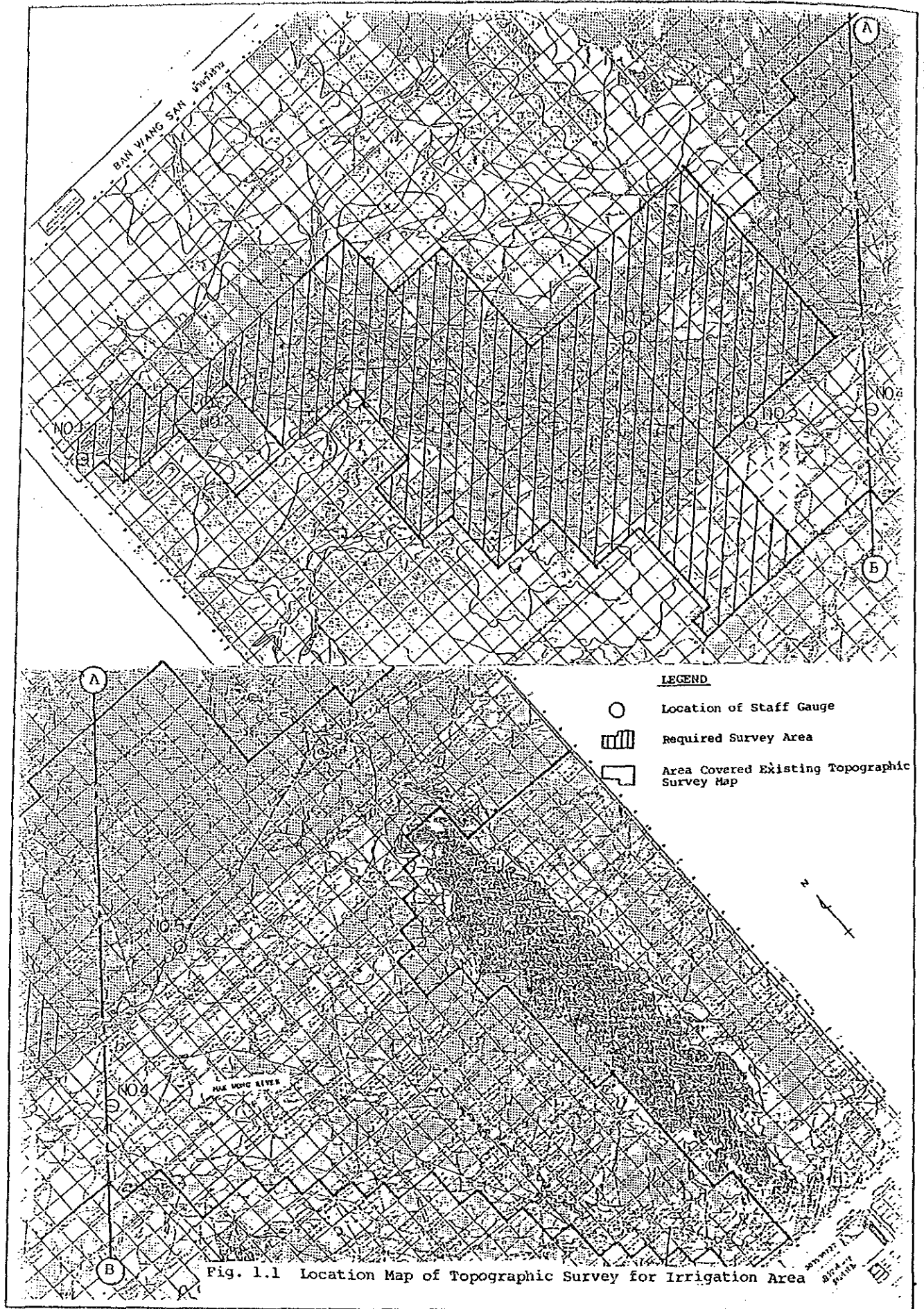


Fig. 1.1 Location Map of Topographic Survey for Irrigation Area

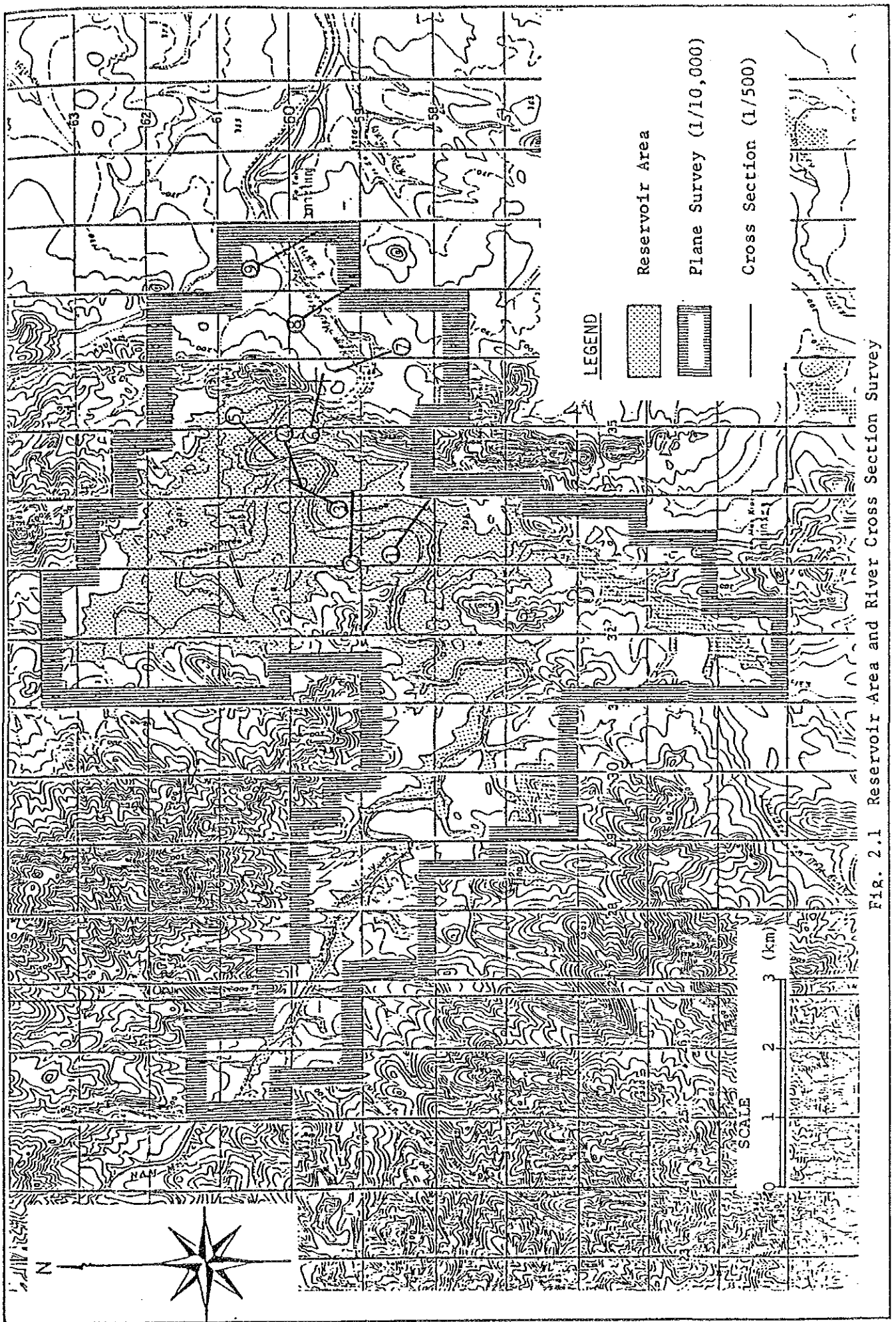


Fig. 2.1 Reservoir Area and River Cross Section Survey

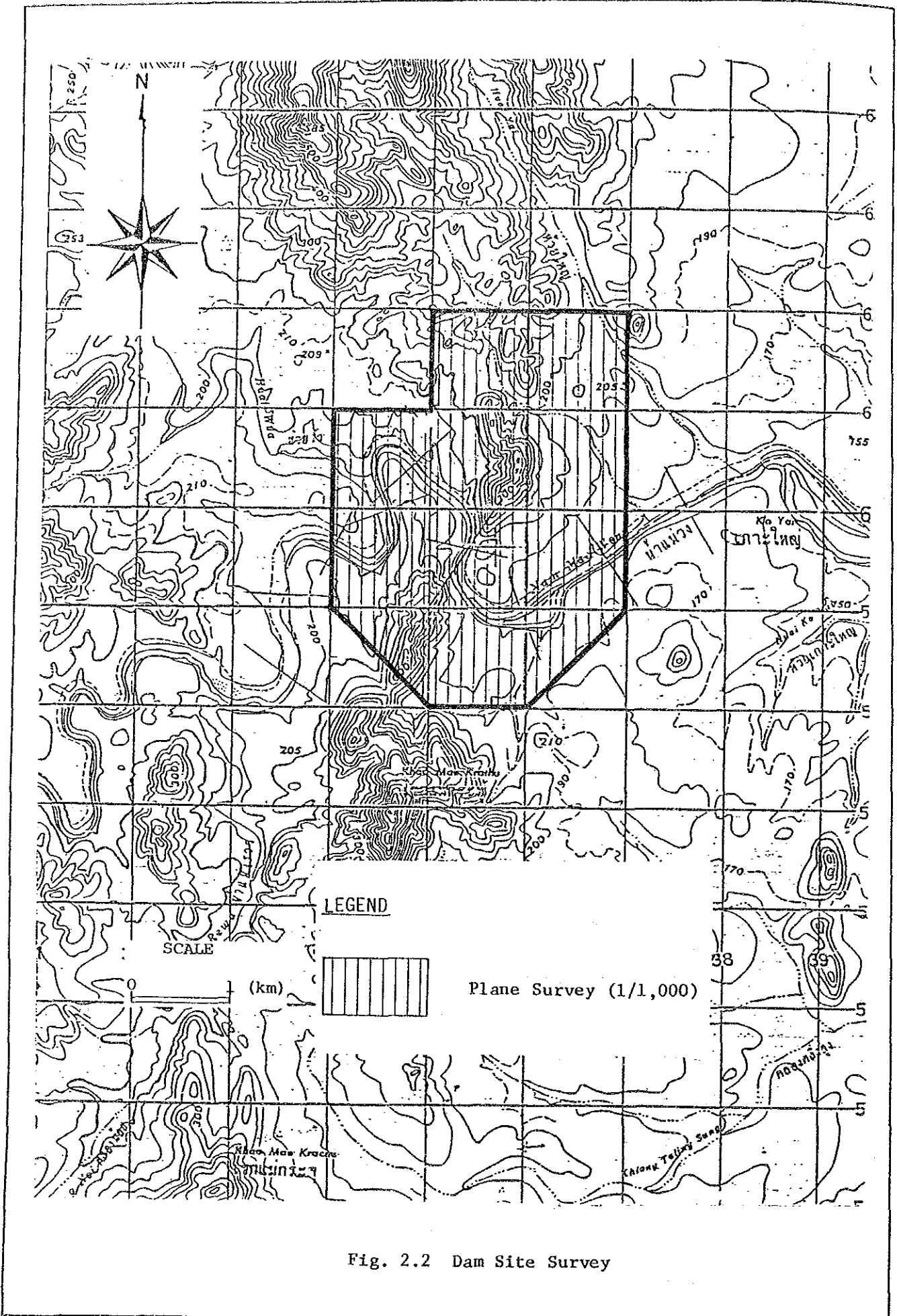
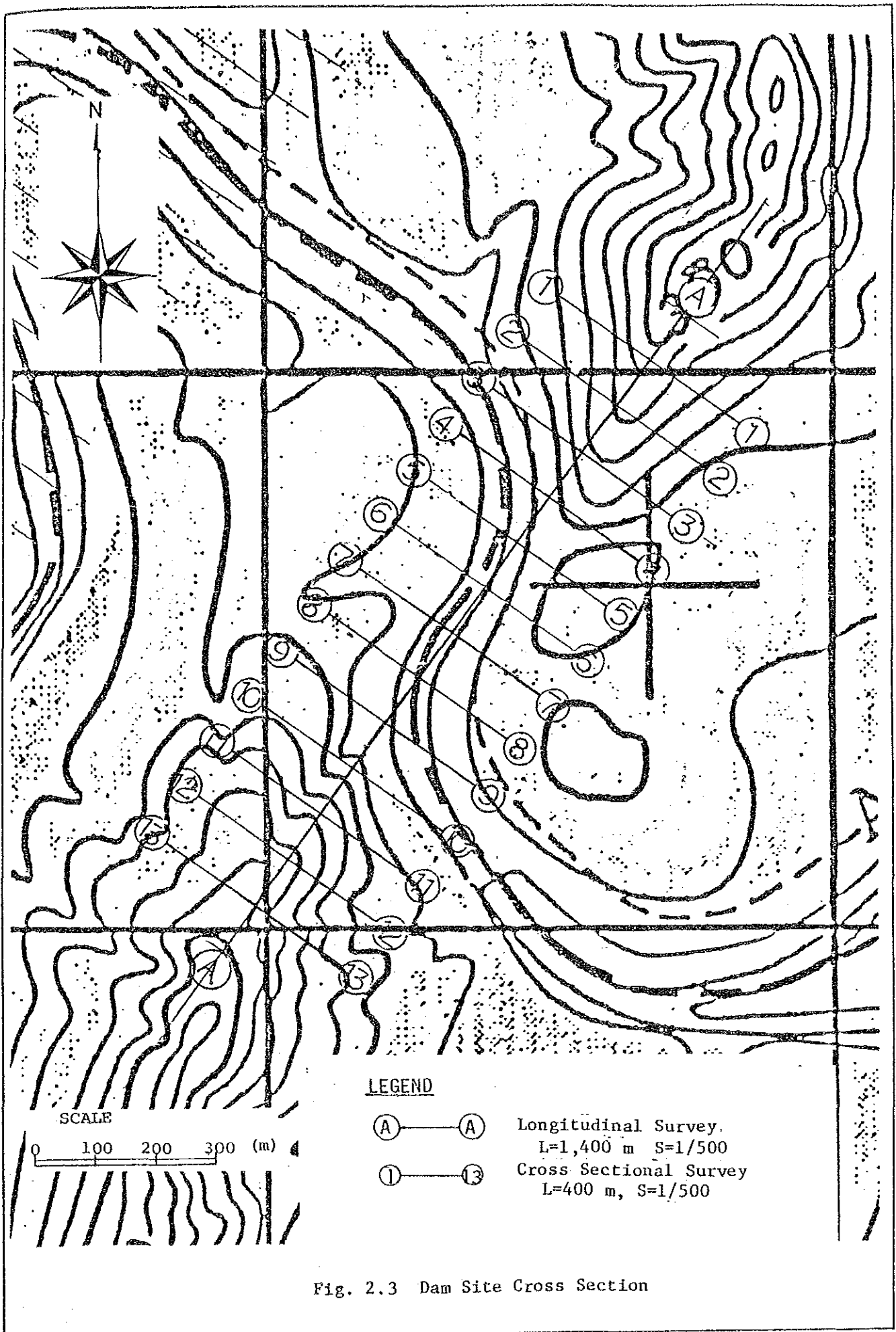


Fig. 2.2 Dam Site Survey



LEGEND

Ⓐ — Ⓐ

Longitudinal Survey.
L=1,400 m S=1/500

① — ⑬

Cross Sectional Survey
L=400 m, S=1/500

Fig. 2.3 Dam Site Cross Section

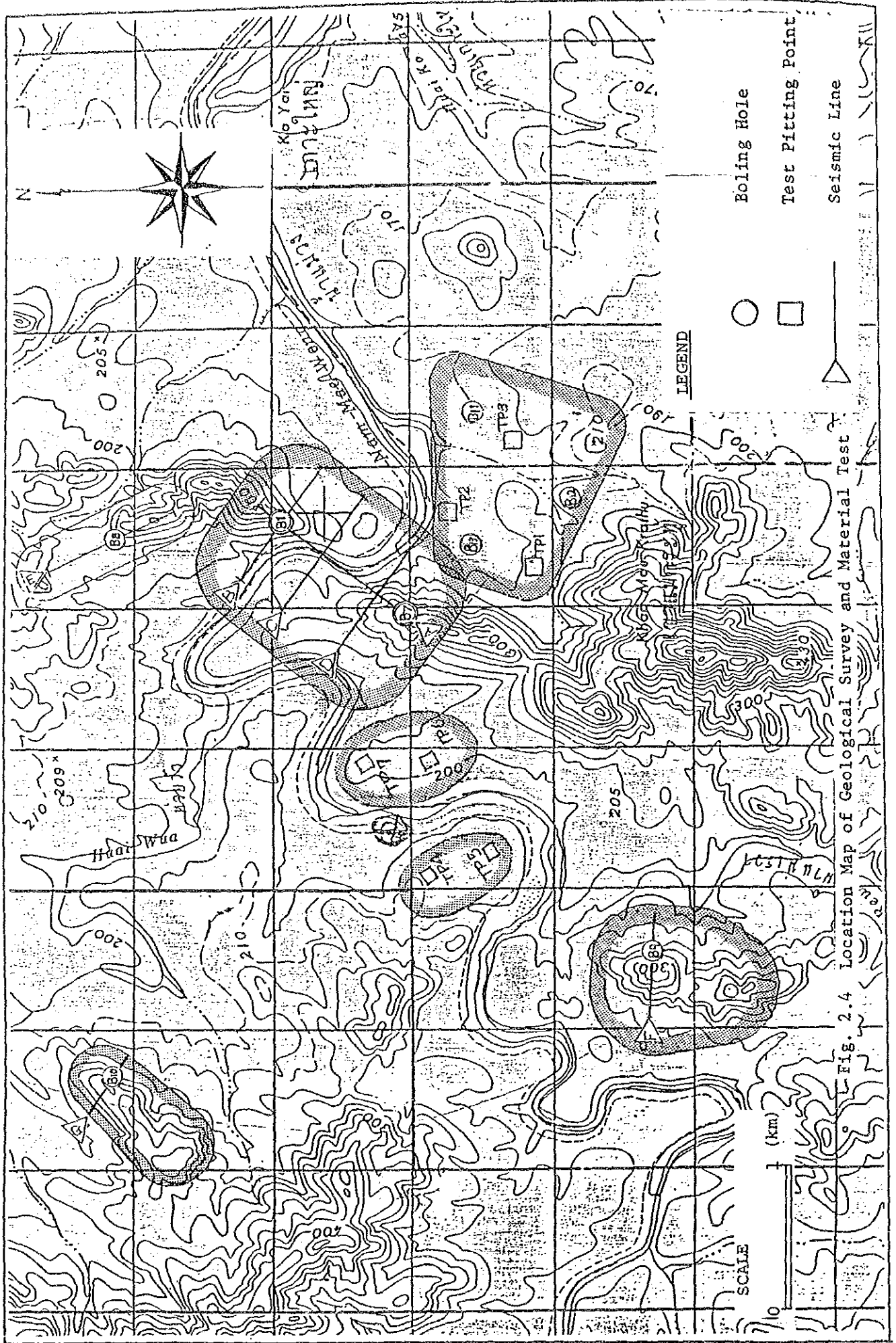


Fig. 2.4 Location Map of Geological Survey and Material Test

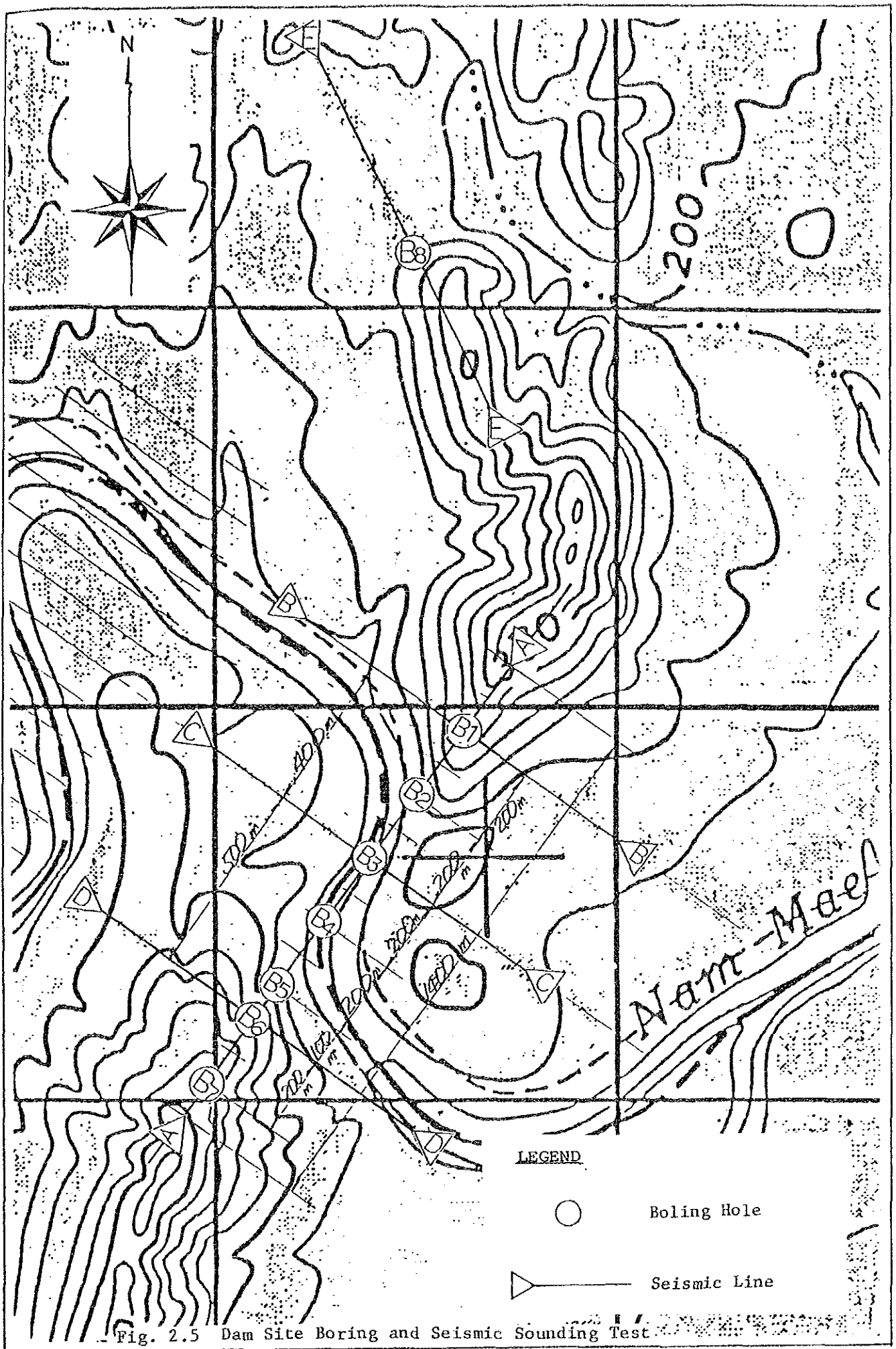


Fig. 2.5 Dam Site Boring and Seismic Sounding Test

