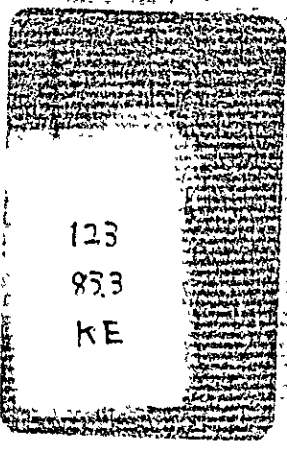




NOTE
ON
THE UPPER SREPOK-DARLAC IRRIGATION PROJECT
VIET NAM

THE UPPER SREPOK INVESTIGATION TEAM
ORGANIZED BY
THE OVERSEAS TECHNICAL COOPERATION AGENCY
TOKYO, OCTOBER 1963



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国際協力事業団	
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Appended Map:

General Map of the Upper Srepok-Darlac Project.

Preface

The Government of Japan, which had conducted a hydrologic investigation of the Upper Srepok in Viet Nam in the fiscal year 1961, was requested again at the 17th Session of the Committee for Coordination of the Lower Mekong Basin held in Tokyo in March 1962 to assist the preliminary investigation and planning on the comprehensive development of the Upper Srepok Basin. The Government of Viet Nam also expressed its earnest desire and asked the Government of Japan for the same investigation works as a part of the development project of the Central Plateau around of Ban-Me-Thout on the basis of the "Reconnaissance Report of the Major Tributaries of the Lower Mekong Basin" already submitted by the Government of Japan. Under these circumstances, the Government of Japan entrusted the investigation work to the Overseas Technical Cooperation Agency, which is the executive agency of the Government, with the budget for the fiscal year 1962. Upon conclusion of the Service Agreement with Nippon Koei Co., Ltd. the Agency organized a Survey Team and carried out a field investigation during the period from December 1962 to March 1963.

The scope of work conducted by the Survey Team was based on the "Plan of operation" and covered the Darlac Basin in the main.

As the result of this investigation, it is confirmed that the development of the Darlac Basin should not be projected exclusively for the basin itself, but as a part of the comprehensive development project of the whole Upper Srepok area including flood control, storage of water, and irrigation in the light of specific natural

/conditions

conditions especially hydrologic features of the Darlac Basin.

This report is compiled, accordingly, from such a viewpoint as mentioned above.

CHAPTER I

INVESTIGATIONS

The investigations were conducted according to "Plan of operation" for the investigation of the irrigation scheme of the Darlac low-lying area in the basin of the Upper Srepok.

The principal contents were as follows.

A. Project investigations

- (1) Review of the results of reconnaissance survey undertaken under the Japanese contribution and confirmation of the feasibility of development.
- (2) Survey
- (3) Hydrologic investigation
- (4) Geological investigation
- (5) Agricultural investigation

B. Aerial mapping of irrigable area

C. Project planning

D. Project design

E. Project evaluation

F. Preparation of Comprehensive Project Feasibility Report

In accordance with the foregoing investigation program, such field works as, mainly, survey, boring, and agricultural investigation were carried on for a three-month period from January 1, to the end of March, 1963.

And the hydrologic investigation was conducted up to the end of March 1963, subsequently to the works by the contribution of the Government of Japan, which was the Hydrologic Investigation

/Project

Project on the Upper Srepok commenced in 1961. These field works were successfully completed by the end of March 1963. The staff engaged in this planning and investigation works are as follows:

<u>No.</u>	<u>Name</u>	<u>Designation</u>
1.	Y. Kubota	President
2.	M. Sugawara	Agronomist
3.	I. Arimoto	Civil engineer
4.	M. Sakaita	Geologist
5.	K. Shibata	Irrigation engineer
6.	R. Yoshida	Civil engineer
7.	T. Yoshimatsu	do.
8.	S. Yano	Irrigation engineer
9.	R. Yokota	do.
10.	H. Hoshino	Geologist
11.	K. Irie	Irrigation engineer
12.	S. Arisaka	Civil engineer
13.	H. Kamiyama	do.
14.	K. Tadano	do.
15.	I. Suzuki	do.
16.	S. Inagaki	Survey expert
17.	I. Ikejima	do.
18.	H. Kumagawa	do.
19.	M. Kuwabara	Office manager

/1. Survey

1. Survey

The principal contents of the survey carried out at the sites were as follows:

- (a) Profile leveling extending over 83 kilometers of the Ea Krong Ana River.
- (b) For aerial mapping, about 157 kilometers datum point survey together with ground control survey.
- (c) About 0.3 square kilometers topographic survey on a scale of 1/2,000 in the vicinity of the intake weir site and rapid on the Srepok river.

2. Hydrologic investigation

At Kana and Ban Bur gauging stations, the observation of water stage has been made and the measurement of stream discharge has been taken subsequently since November 1961, and those works are still going on.

3. Geological investigation

Geological investigation was conducted all over the project area. In addition, total 92 meters core boring was drilled at the proposed intake weir site.

4. Agricultural investigation

A detailed soil survey and agricultural investigation were carried out within the irrigation project area.

5. Aerial mapping of photographs

The aerial mapping of topography, on a scale of 1/20,000 covering about 200 square kilometers of the Darlac Project Area was made by the aid of the aerial photographs taken by U.S. Army Map Service and the result of the survey made by the Investigation Team.

/CHAPTER II

CHAPTER II

OUTLINE OF THE COMPREHENSIVE UPPER SREPOK PROJECT

Regarding to the development of the Upper Srepok Basin, several projects were considered and proposed for each sectional areas of the basin as they were explained in the "Comprehensive Reconnaissance Report on the Major Tributaries of the Lower Mekong Basin".

Out of these projects, the Darlac Basin Project is taken up as the object of our present investigation.

As for this project, the area is usually flooded with the overflows of the Ea Krong Ana and other streams and the stagnant water is drained so slowly that the considerable areas of depressions are still inundated throughout the dry season. Such inundation is mainly due to the specific topographical conditions of the Darlac Basin and its surrounding area.

If all of these areas are enclosed with embankments so that no areas would be inundated, the flood discharge of the Ea Krong Ana would be enormously enlarged in quantity. Consequently, our presupposed plan to protect the Darlac Basin against flood by the construction of surrounding embankment must be reconsidered and revised, and we come to a conclusion that it is indispensable to construct reservoirs for flood control at the upper reaches of the rivers above the Darlac Basin.

/Fortunately

Fortunately, in the following 1963 fiscal year, the investigation over the whole area of the Upper Srepok Basin is undertaken by the Government of Japan with the agreement of the Mekong Committee. The development plan will finally be established when the results of this investigation become available. The present report attempts to establish the urgent plan aimed at the stabilization of the farmers' livings already settled into this area by the practice of adapted irrigation farming in the dry season.

CHAPTER III

OUTLINE OF DEVELOPMENT PLAN FOR DARLAC AREA

3.1. Examination of original plan

The initial plan to irrigate the Darlac Basin was to build a weir across the Ea Krong Ana at the east end of the basin and to maintain the water stage of the Ea Krong Ana at El.422 meters in order to irrigate about 7,000 hectares of land by gravity flow.

In the light of our examination, however, we confirmed the disadvantages of this plan as follows.

- (1) The continuous maintenance of water stage at El.422 meters or more will inundate a considerable wide area and hinder the drainage of reclaimable fertile land in the upstream basin above the barrage.
- (2) The completion of detailed topographic maps reveals that there are fairly large depressions within this area and that it is impossible to command them by one irrigation system.
- (3) The construction of intake weir across the Ea Krong Ana along with canals for gravity flow irrigation is rather expensive as compared with the procedure to supply irrigating water by pumping up to some extent.

Then, the revised plan is summarized as follows.

The irrigable area in the Darlac Basin is enlarged and estimated at about 8,000 hectares. This land can be divided into six lots A - F

/on appended

on appended map.

The development of high-elevated land not affected by flooding of the Ea Krong Ana (Lot A and B on appended map) can be carried on independently. The soils in these areas are infertile in comparison with those in lowland area. But, as the farm management is rather stabilized here, the development of these lots can be deferred till later on.

In Lot C, two settlements have already been established with 500 farm households engaged in farming. They raise one crop a year during the rainy season. Soil is rather fertile, but crop is damaged every year by inundation, and farmers can not expect satisfactory harvest at all times. As a relief measure, the utilization of the dry season by the practice of irrigation farming is considered. First priority shall be given to Lot C.

3.2. Irrigation and drainage plans

The present irrigation scheme for the Darlac Basin may be contemplated as follows:

As an area for first stage development, about 1,000 hectares of central lowland along the Ea Krong Ana will be selected. (Refer to high elevated land on Map.) On this land, two crops a year can be grown by applying the water of the Darlac dammed up to EL.420.5 meters.

As for the remained area of the Darlac Basin, its development is desirable to be considered as a part of the comprehensive development projects all over the Upper Srepok Basin in the future.

/ The drainage

The drainage scheme on the first development areas should be worked out at a later date when the flood control works along the Upper Ea Krong Ana and the Upper Ea Krong Kno would be completed. Some drainage canals, however, shall be provided within this areas for the purpose of shortening the period of inundation on land so that the drained water can be discharged into the Ea Krong Ana at their lower ends.

3.3. Agricultural improvement

As a means of agricultural improvement in the Darlac Basin, the combined management of paddy field and dairy farming is recommended, by introducing stock-raising into the farming unit.

The essentials of a farming unit is as follows:

- a. The area of operation shall be 2 hectares per farm household.
- b. The most principal crop for farmers livelihood shall be paddy together with vegetables. In addition, beans, maize, and pasture grass shall be grown as a means of self-supplying of feedstuff. As products for markets, kenaf, tobacco, peanuts and green beans can be cultivated. As to the variety of paddy, it is advisable to select a early-maturing variety which can be harvested within 120 to 150 days.
- c. For the lowlands where stagnant water stays for a long period during the rainy season, the cultivation of floating rice is recommended.

/ 3.4.

3.4. Rough estimation of construction cost

The construction cost of the installments necessary for first stage development covering 1,000 hectares is estimated at about US\$270,000 that is equivalent to US\$270 per hectare.

3.5. Benefit and evaluation

a. Benefit

When 1,000 hectares of land have been developed and irrigation farming has been practiced, the total price of annual crop products would be increased and estimated as follows: (Unit: U.S.Dollars)

<u>Crop</u>	<u>Before irrigation</u>	<u>After irrigation</u>	<u>Income increased</u>
Rice	40,000	150,000	110,000
Crops for market	15,660	207,200	191,540
Vegetables & fruits	17,500	56,000	38,500
Forage	—	33,600	33,600
Total	73,160	446,800	373,640

In addition to this, the total price of live-stock products such as milk, meat, eggs, and young animals can be estimated at about US\$112,000 a year after ten years of the introduction of live-stock raising. Then the total amount of annual crop and live-stock products are estimated at about US\$485,000 that is approximately equivalent to US\$485 per hectare.

b. Benefit-cost Ratio

According to the method indicated in the ECAFE report (Flood

/Control

Control Series No.7, Part I, Chapter III), benefit-cost ratio is computed as shown below.

$$\text{Benefit-cost Ratio} = \frac{\text{Benefit}}{\text{Cost}} = 1.7$$

where, Annual increased benefits	US\$ 485,000
Annual costs	US\$ 288,000
Annual repayment of construction cost	20,000
Annual operation and maintenance cost	10,000
Annual farming expenses needed for cropping and live-stock raising	258,000

As shown in the above computation, the benefit-cost ratio of this project is estimated at 1.7, that is remarkably higher than 1.0. Therefore, this project can be evaluated to be economically justifiable.

As for the farm management by farmer, he can get annual net benefit of about US\$100 by deducting the repayment of construction cost, operation and maintenance cost and farming expenditure inclusive of living expenses from his annual gross income.

CHAPTER IV

CONCLUSION AND RECOMMENDATION

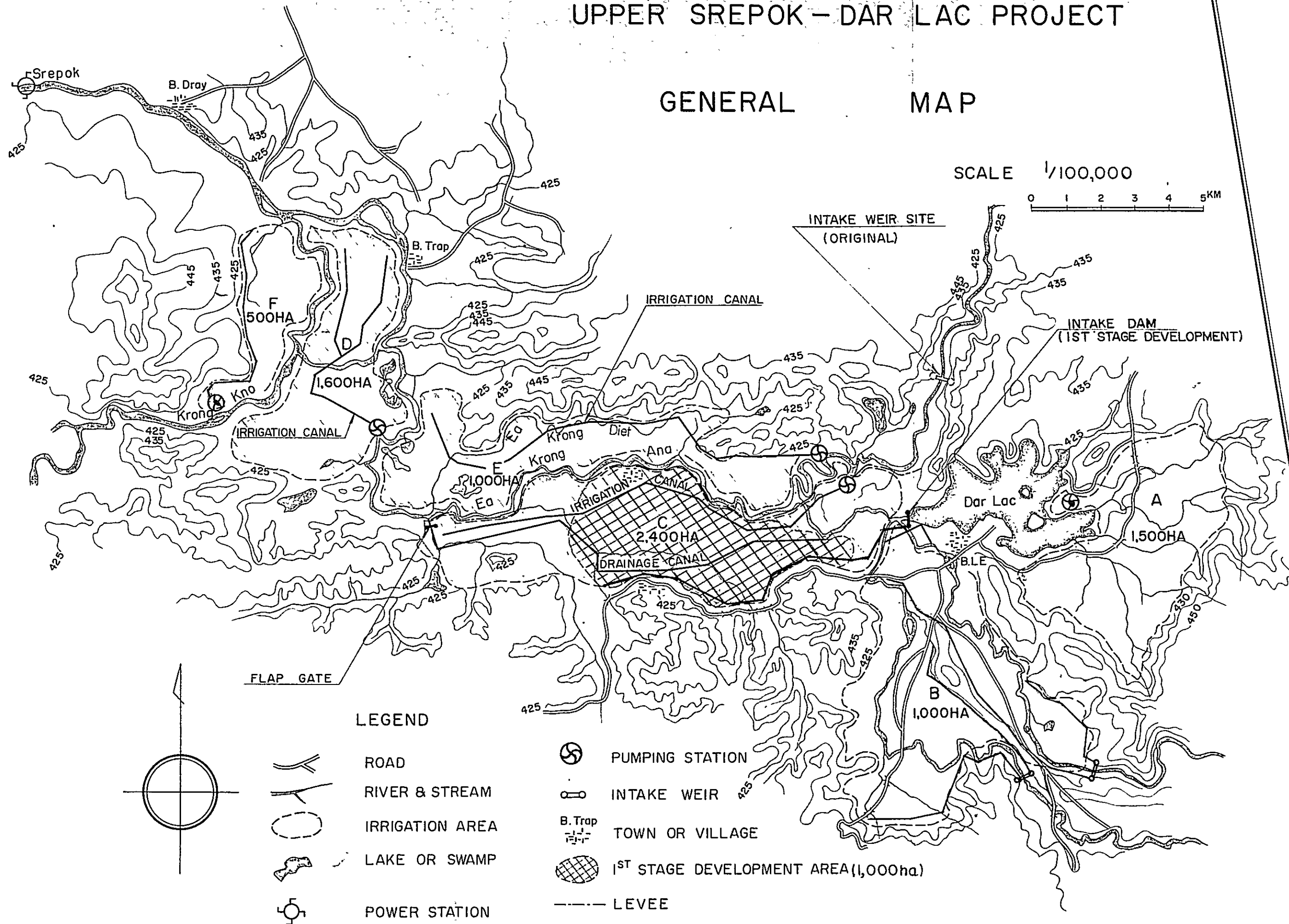
(1) Since this project area is situated in the lower reaches of the Upper Srepok, it is inevitably required to consider it as a link in the chain of the comprehensive Upper Srepok Project covering the basins of the Krong Buk, the Krong Pach, the Krong Boun and other rivers. In this area, however, about 500 hectares of lowland have been cultivated, and 2 hamlets have been established already. In order to stabilize these farmers' agricultural managements as early as possible, it is imperative to perform the development works of this area within the limits of an economically justifiable investment so as to enable the farmers to maintain profitable irrigation farming during the dry season and to protect their lives against the sufferings from periodic floods.

(2) As the drainage of the Darlac Basin is vitally affected by the flood control works for the upstream reaches, ^{The}~~the~~ final drainage plan shall be completed jointly with the planning of the upstream basin projects.

UPPER SREPOK - DAR LAC PROJECT

GENERAL MAP

SCALE 1/100,000



FLAP GATE

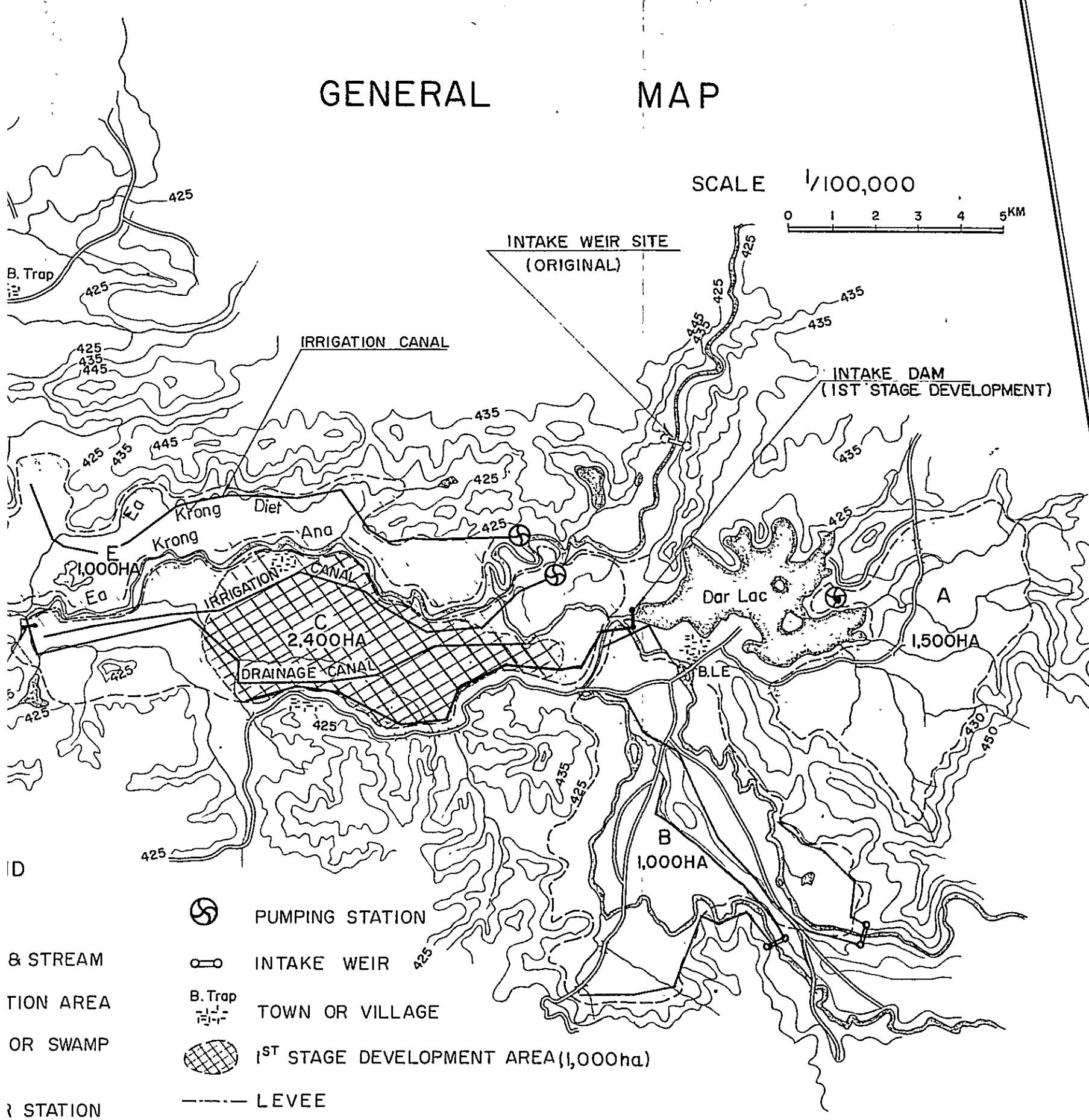
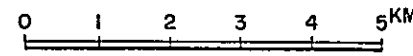
LEGEND

- | | | | |
|--|-----------------|--|--|
| | ROAD | | PUMPING STATION |
| | RIVER & STREAM | | INTAKE WEIR |
| | IRRIGATION AREA | | TOWN OR VILLAGE |
| | LAKE OR SWAMP | | 1 ST STAGE DEVELOPMENT AREA (1,000ha) |
| | POWER STATION | | LEVEE |

UPPER SREPOK - DAR LAC PROJECT

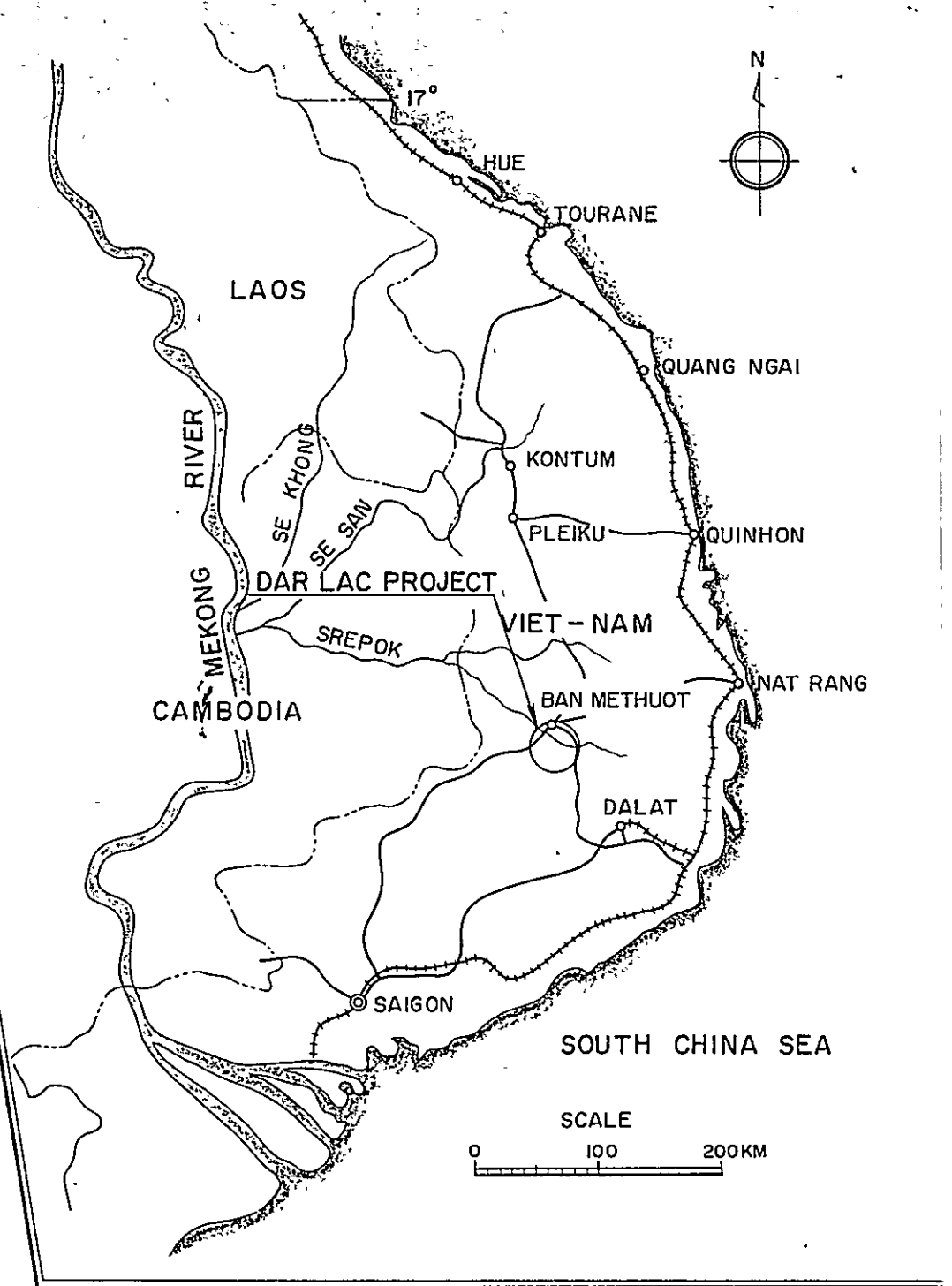
GENERAL MAP

SCALE 1/100,000



ID

- PUMPING STATION
- INTAKE WEIR
- TOWN OR VILLAGE
- 1ST STAGE DEVELOPMENT AREA (1,000ha)
- LEVEE



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