

JAPAN INTERNATIONAL
COOPERATION AGENCY (JICA)
MINISTRY OF WATER RESOURCES
THE SOCIALIST REPUBLIC OF VIET NAM

THE STUDY
ON
IMPROVEMENT PROJECT OF DRAINAGE SYSTEM
IN
SOUTH BAC DUONG AGRICULTURAL AREA
IN
THE SOCIALIST REPUBLIC OF VIET NAM

MAIN REPORT

MARCH, 1995

SANYU CONSULTANTS INC.
TAIYO CONSULTANTS CO.,LTD.

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PREFACE

In response to a request from the Government of Viet Nam, the Government of Japan decided to prepare a master plan on the improvement of drainage system and related agricultural development and to conduct a feasibility study for the selected project area in South Bac Duong Agricultural Area and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent a Study Team headed by Mr. Fumimichi OBU, Sanyu Consultants Inc., to Viet-Nam, three times between April, 1994 and January, 1995.

The Study Team held discussions with the officials concerned of the Government of Viet Nam, and conducted a field survey at the Study area. After the Study Team returned to Japan, further studies were made and the present report was prepared.

I hope that this report will contribute to the promotion of the project and enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to officials concerned of the Government of Viet-Nam for their close cooperation extended to the Study Team.

March, 1995



KIMIO FUJITA

President

JAPAN INTERNATIONAL COOPERATION AGENCY

March, 1995

Mr. Kimio FUJITA
President
Japan International Cooperation Agency
Tokyo, Japan

Letter of Transmittal

Dear Sir,

We are pleased to submit the study report on the Improvement Project of Drainage System in South Bac Duong Agricultural Area of the Viet Nam. The report compiles the advice and suggestions of the authorities concerned, the Government of Japan and your Agency as well as the formation of the above-mentioned project. Also comments made by the Ministry of Water Resources and other agencies of Viet Nam during the discussions which were held in Hanoi and the explanation of Draft Final Report, are compiled in the report.

This Report presents a scheme for drainage/irrigation improvement and promotion of inland fishery which local farmers have been desiring earnestly for the past many years. The project will meet basic human needs and extend socioeconomic impact on activation of the rural area, assuring poverty eradication, prevention of disease and food security by stabilization of farming.

The Socialist Republic of Viet Nam has been rapidly developing under the market system, but most of local people who live in the project area located within the Red River Delta are economically deprived and are suffering from poverty. Economic gap between urban and rural areas is also becoming larger. In order to realise a comfortable life in the rural area, improvement of rural living environment is required in addition to improvement of agricultural infrastructures. Medium and long term plans proposed in this report will surely give a great impact on the agricultural and rural areas in Viet Nam.

We wish to take this opportunity to express our sincere gratitude to your Agency, the Ministry of Foreign Affairs, the Ministry of Agriculture, Forestry and Fisheries. We also wish to express our deep gratitude to the Ministry of Water Resources and other authorities concerned of the Socialist Republic of Viet Nam for the close cooperation and assistance extended to us during our investigation and study.

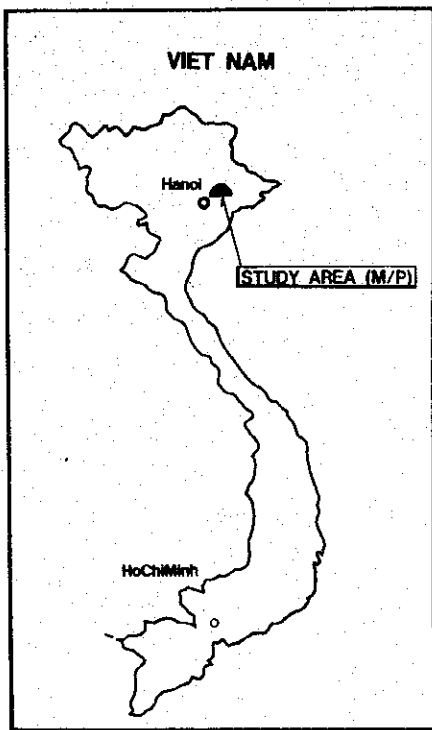
Very truly yours,



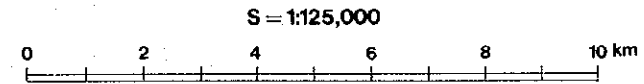
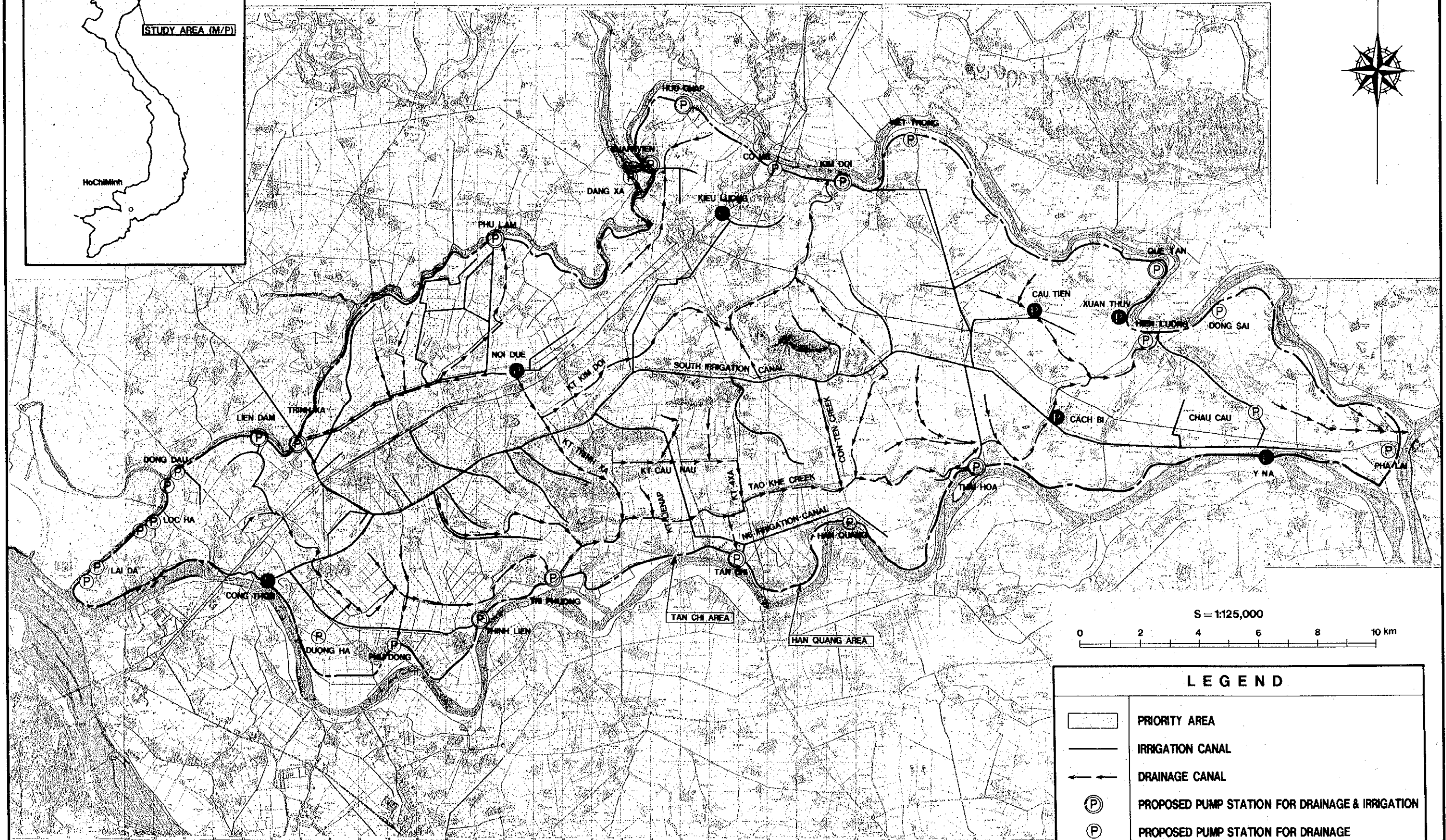
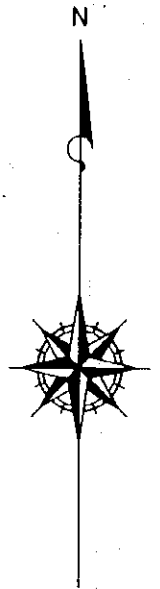
Fumimichi OBU
Team Leader

Study on the Improvement Project of Drainage
System in South Bac Duong Agricultural Area

VIET NAM

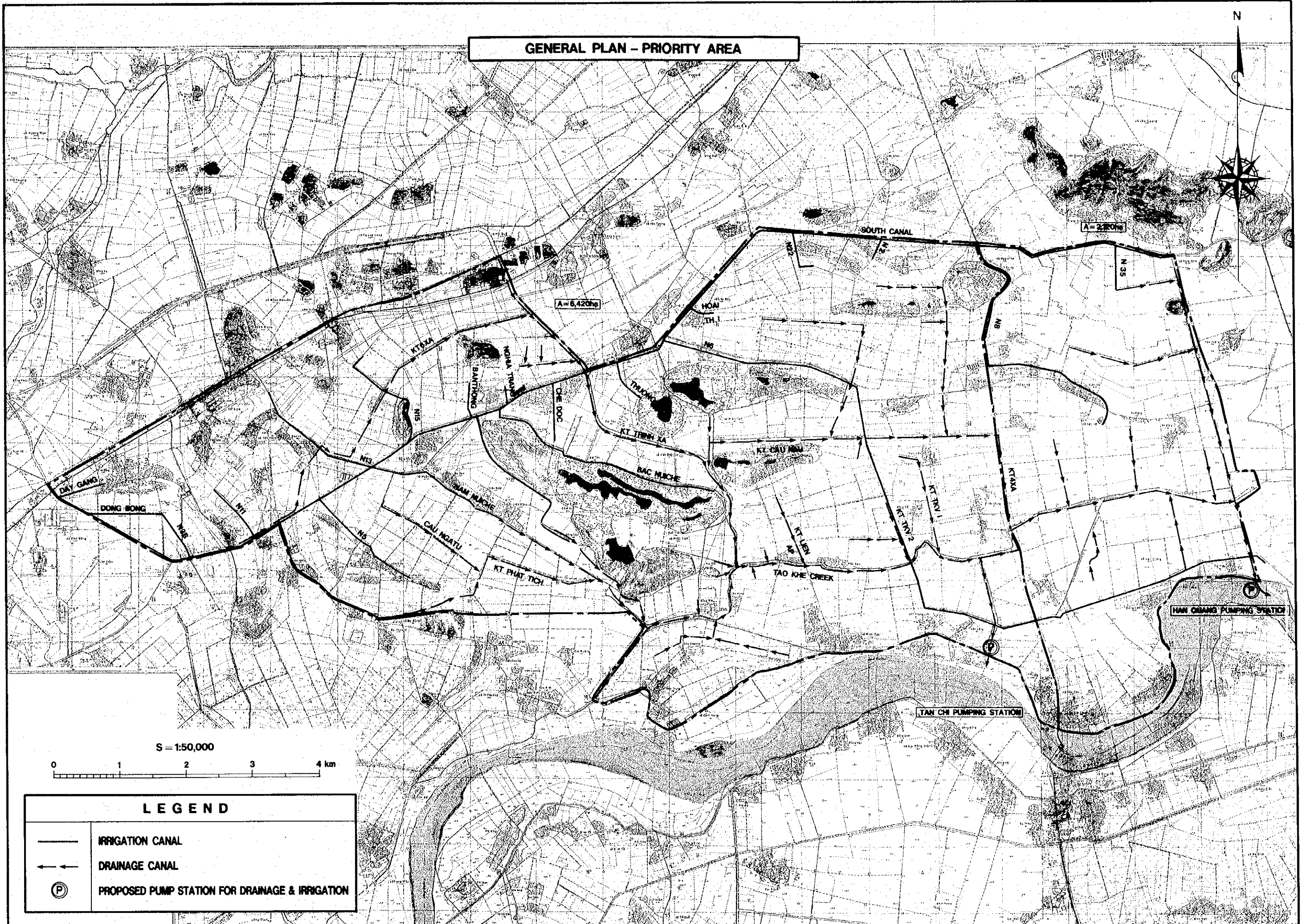


GENERAL PLAN - MASTER PLAN AREA

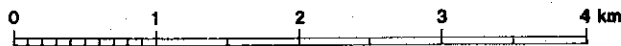


LEGEND	
	PRIORITY AREA
	IRRIGATION CANAL
	DRAINAGE CANAL
	PROPOSED PUMP STATION FOR DRAINAGE & IRRIGATION
	PROPOSED PUMP STATION FOR DRAINAGE
	EXISTING PUMP STATION FOR IRRIGATION




GENERAL PLAN - PRIORITY AREA



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LEGEND

-  IRRIGATION CANAL
-  DRAINAGE CANAL
-  PROPOSED PUMP STATION FOR DRAINAGE & IRRIGATION

SUMMARY

SUMMARY

A MASTER PLAN STUDY

A-1 Introduction

The Government of Viet Nam aims at increase of food and growth of Gross National Product as a major target in the Fifth Five Years Plan (1991-95). South Bac Duong agricultural area is located in the Red River Delta and is of great advantage to farming, but a large area of farm land is inundated every year by persistent floods. Farming in the area is inactive and farmers are suffering from poverty.

The Government of Viet Nam has been giving the first priority to alleviate poverty and raise the standard of living by improving the productivity of agricultural land and requested the Government of Japan to extend the technical assistance for formulation of the Improvement Project of Drainage Systems in South Bac Duong Agricultural Area.

A-2 Background

The agricultural sector in Viet Nam plays an important role in the national economy. The sector accounts for 35 percent of the GDP and 50 percent of the national income. Food grain, particularly paddy rice production is a major component of the sector.

This sector absorbs a greater proportion of the labor force: almost 72 percent is engaged in agriculture. But, farm sizes are too small to employ the full labor force even at the peak demand. Underemployment is predominant in rural area.

The recent economic renovation brought about considerable activities in agricultural production. The Government of Viet Nam has pursued the maximum use of land resources to enhance more agricultural productivity. In order to achieve these objectives, the Ministry of Water Resources has prepared the Investment Plan and Development Orientation in the water resources sector. The Plan gives a priority to the development of the northern area, particularly leading in the Red River Delta, aiming to control inundation problems, and improve irrigation capacity and efficiency.

A-3 The Study Area

(1) Natural Condition

The Study Area is located at 30 km northerneast of the Capital Hanoi. The area extends over three districts and one town in Ha Bac province and two district in Hanoi City, and have a gross area of some 40,000 ha.

The climate of the area is categorized as the monsoon zone. Average annual rainfall is about 1,660 mm, of which 90 percent falls in July to September. The annual mean temperature is 24°C. About 6 typhoons land on the area in a year.

The area forms the big polder surrounded by three rivers and consists of numerous drainage blocks.

Almost all soils in the Study Area are undeposited alluvial soils, water logged alluvial soils and degraded soils. The latter two soils are problem soils which are acidic and very poor in phosphorus. The area have 26,700 ha of annual crops of which rice is mostly cultivated. Perennial crops occupying 190 ha is less well developed.

The lending system by farmer's cooperative is mostly applied for land holding in the area, however some cooperatives are still keeping the collective farming system.

(2) Present Agriculture

Rice is the staple food in the area. The average paddy yield is 3.4 ton/ha. Subsidiary and industrial crops such as maize, sweet potato, groundnut, soybean and vegetable are cultivated. The cropping intensity in the area is 1.93.

Buffalo, cattle and pig are the main livestock in the area. The VAC ecosystem developed in the Red River Delta is a highly intensive method of small-scale farming in which food grading, fish rearing and animal husbandry are wholly integrated. This system has been recently recognized from a view point of economy and nutrient supply.

The area used as inland fishery is 1,270 ha where water logging continues for a long period due to lack of drainage facilities. Carp, catfish, frog and tortoise are cultivated by farmers.

60 percent of paddy consumption in the area is milled by manual and the remaining is depended upon small scale mills managed by villages.

The milling loss is high at 16 percent. Improvement of post-harvest facilities are required.

(3) Present Agricultural Infrastructures

Irrigation

Irrigation in the area is mainly served by pumping system and supplied from three rivers surrounding the area. The quantity of irrigation water supply is not sufficient to irrigate the east part of the area for winter/spring crops. The drought has occurred in about 15 percent of the cultivated area on an average.

The land areas irrigated directly from the canal system are very limited, due to poor maintenance, deterioration of the facilities and dual use of canals for irrigation and drainage.

Drainage

About 21 drainage pumping stations built in 1962-81 exist and operate to drain the excess water in the rainy season. The inundation damage to crops is in routine and suspension of summer cropping land is increasing every year due to much rainfall, shortage of drainage pump capacities and under-developed of drainage canal networks.

The inundated area occurs every year and spreads to a land area of some 5,200 ha. The damages by floods extend to not only crop damages and lower yielding but also the collapse of road and polder dikes, worsening of ecological and living conditions.

(4) Agricultural Economy

Population in the area is about 473,000 with 103,230 households and its density is 1,202 persons/km². 90 percent of the whole households engages in agriculture. The average area of farmland per households is 0.24 ha and this is lower than that of national level (0.33 ha).

GDP of 1992 in Ha Bac province account for 1.7 percent of the country. Food production of the province is 665,700 tons (2.7 percent of the country) equivalent to 300 kg per capita.

The poverty group of the area occupies 18.3 percent, of which annual income is below 100 US\$.

(5) Social Infrastructures and Administration

The existing road networks are considered as sufficient for present traffic but their width is narrow, unpaved and unaccessible after rainfall. Most of villagers are obtaining their domestic use water from shallow wells. No sanitary consideration is applied neither at well nor pond despite of such conditions as outbreak of water borne diseases is very easy.

Most of communes are equipped with a health office/clinic to promote the family planning in parallel with the medical treatment of rural inhabitant.

The average schooling experienced ratio of 6 related districts of the Study Area is as high as 90 percent. One primary/secondary school is allocated at each commune. Regarding rural electrification, most of villages in the area received electrification in 1970-1980s.

(6) Environment

The environmental issues in the Study Area are mainly water quality of rivers, agrochemicals use, urbanization.

According to the Initial Environmental Examination (IEE), impact on the improvement project of drainage system in the area will be minor. Regarding environmental influences on changes of water management by the Project, the optimal plan and design should be considered.

Negative influences such as surplus use of agrochemicals, increase of domestic waste water and other wasted materials may come out in and around the area with the progress of agricultural development and urbanization.

Positive impacts are expected with the activation of local economy by the implementation of the Project such as improvement of living standard, convenience of transportation and creation of new jobs.

A-4 Development Plan

(1) Development Concept

The objectives of the development under this Master Plan are:

- 1) To improve living standards of local people.
- 2) To conserve and improve natural/social environment of the agricultural area affected by inundation.
- 3) To contribute to the national economy and the public welfare.

In order to achieve the objectives, development strategy is focussed upon the following issues in the short term plan up to 2000 year.

- 1) To prepare the master plan on irrigation and drainage systems in the Study Area and select the highest priority area.
- 2) To commence rehabilitation projects for irrigation and drainage works following development priorities.
- 3) To upgrade farm roads and bridges connecting to main roads and irrigation and drainage facilities.
- 4) To strengthen agricultural supporting systems and research works including crops, livestock and inland fishery.

The area will become as one of the major food producing regions for the Capital Hanoi. To establish the stable agricultural area as a food supply base depends upon the success of structural readjustment. In the medium term plan up to 2010 year, the following components will be listed.

- 1) Allocation of land to stability of rural economy.
- 2) Improvement of rural infrastructures such as water supply, transport facility.
- 3) Improvement of social public facilities such as education, public health and communication.

(2) Agricultural Development Plan

The basic concept on the agricultural development plan is:

- 1) To develop more high profitable, marketable farm products with low cost and less labor force.
- 2) To improve post-harvest facilities and distribution system.
- 3) To absorb surplus labor force into agro-processing.

- 4) To meet the demand for high quality of farm products, animal husbandry, legume crop production and inland fishery is proposed to promote.
- 5) To apply agrochemicals and fully utilize Farm Yard Manure against degradation of environment.

Proposed Cropping Pattern

Two cropping patterns have been proposed in this master plan.

Pattern A:

- 1) The paddy area is provided same as the level of 1993 to produce rice as much as possible.
- 2) Vegetable, subsidiary crops (maize, sweet potato, potato) and short industrial crops (groundnut, soybean) will be cultivated in the area occupying 25 percent of the two paddy areas to diversify crops and increase farm income.

Pattern B:

- 1) The paddy area in each season is restricted to 15,000 ha which is 80 percent of Pattern A. The remaining 20 percent will be converted to upland.
- 2) Half of the depressed and water logging area in the rainy season will be converted to the stable paddy area by introduction of new drainage systems. The other half deep area will be used for inland fishery.
- 3) 35 percent of the whole summer paddy area is subjected to subsidiary crop cultivation.

Cropping Intensity	Present	1.93
	Proposed (A)	2.02
	Proposed (B)	2.32

For getting the profit from agriculture in the limited area, intensification of cropping such as more subsidiary crops cultivation in the paddy field and cash crops cultivation throughout the year is necessary in farm management.

Animal Husbandry

Buffalo and cattle are very important animal husbandry in the Study Area not only meat and FYM producer. Paddy straw is a major feeding material and its production is one of the controlling factors to increase the number of animal. For

the development of animal husbandry, how to secure feeding materials and how to cultivate fodder crops is the serious problem in the future.

Inland Fishery

A half of the low lying area, 5,126 ha under the flooded water for 5 to 6 months per year is proposed to be converted to the area of inland fishery. Rice + Fish + Fruit Tree system is recommendable considering the capacity of fund prepared by farmers.

Agro-Processing

Rice processing to dry paddy is the important subject in this sector. As a long term plan, installation of country elevators is proposed. The most capable material for agro-processing is sweet potato in terms of easy cultivation/processing and other uses.

(3) Improvement of Agricultural Infrastructures

Water Resources Planning

The irrigation water can be supplemented for the Duong River through Long Tuu intake, it is preferable in the future to obtain the water mainly from the Duong River. The water resources planning shall be reexamined, taking into account the water resources development in the entire Red River Delta, the water utilization planning in the upstream basin, and the irrigation water utilization planning in the downstream area of the Ngu Huyen Khe River.

Irrigation System Improvement

The present irrigation shall be improved in order to timely supply the adequate quantity of water to the field, envisaging the future farming plan. The restructuring of irrigation networks and rehabilitation/improvement of the timeworn pumps, deteriorated canals and structures are proposed. Justification on replacement or repair of timeworn pumps depends upon the lapse of time. Replacement of pumps will be made when the lapse time is over 30 years. Repair of pumps including exchange of spare parts will be made when the lapse time is not more than 30 years.

- Trinh Xa existing pumps have better to replace with new ones.
- Structures of South main canal will be improved to have adequate flow capacity.

- Xuan Vien pumping irrigation system will be completely modified by constructing new pumping station.
- Kim Doi area irrigation system shall be irrigated separately through each pumping station.
- In the Dong Anh area irrigation system, the improvement of pumping station will be required for Loc Ha and Lai Da station.
- Gia Lam area irrigation system will be the same at present.

Drainage System Improvement

The improvement plan aims to enhance the land productivity by reducing the persistent water-logging area and improving the rural living environment through renovation of existing pumps, construction of pumping station, improvement/upgrading of canal flow capacity.

For the drainage study, 3 days consecutive rainfall over the Study Area with return period of 10 years has been adopted.

The drainage pump discharge capacity per unit area shall be upgraded from 2.5-4.9 lit/sec/ha at present to 4.7-5.6 lit/sec/ha in the future.

The pumping station on the Ngu Huyen Khe River in Trinh Xa drainage area

- Huu Chap pumping station may be required to inspect and repair all pumps for ensuring the discharge capacity.
- Xuan Vien pumping station is required to replace all pumps with new ones to meet the required drainage discharge.
- Trinh Xa pumping station may need to repair 5 units out off the total 8 units.

Tao Khe drainage system area

- New Tri Phuong station will be still required to add four units of the same type of pumps.
- In Tan Chi pumping drainage area, 68 units of existing pumps will be completely restored/improved and additional four units of pumps will be procured.
- Hien Luong pumping station is required to repair the existing ones and add four units of pumps.
- In the Kim Doi creek, existing pumps will be repaired and added by six units of pumps.

Pumping stations on the Cau River

- Every existing pumps will be repaired/improved.

Along with improvement of drainage pumping stations, dredging of leading Tao Khe and Kim Doi creeks, and improvement/construction of drainage facilities including canal networks shall be implemented.

Marketing and Distribution Plan

The production of rice will be expected to destine for regional consumption. Vegetables are able to expand the markets in the cities with development of agro-industry. Demand of industrial crops such as maize, groundnut and soybean are high and the marketability of these crops will be expected to expand as the living standards improved and as the animal husbandry developed.

The program in terms of distribution system of agricultural products would be proposed as the followings:

- Reorganization of existing farmers' cooperatives.
- Establishment of central marketing association.
- Set up of marketing information network.
- Establishment of well-managed markets for agricultural products in the cities.
- Set up a new transportation system for agricultural products.

Improvement of Rural Infrastructure and Services

When the health of rural inhabitant is considered, the improvement of water supply system shall be implemented first of all and the sewerage disposal system is to follow in this relation. In terms of rural electrification, qualitative improvement will be required due to increase of power demand in near future.

A-5 Selection of Priority Project

(1) Alternative Schemes of Drainage Improvement

Regional Drainage Scheme

The regional drainage system composed of the Ngu Huyen Khe River, Kim Doi creek and Tao Khe creek has demerits in the improvement schemes such as huge cost construction, a longer construction period and delay in benefit accrual.

Decentralization Drainage Schemes

The decentralization drainage scheme is a part of stage development of the regional drainage scheme. The scale of the project will be appropriate for the implementation and faster benefits will be expected.

(2) Evaluation of Alternative Schemes

The drainage schemes for the Study Area have been worked out to evaluate the inundation events and project feasibility, grouping the area into five (5) development blocks; that is, Dong Anh & Gia Lam drainage block, Trinh Xa & Xuan Vien drainage block, Tao Khe creek drainage block, Kim Doi creek drainage block and Chau Cau & Pha Lai drainage block.

Dong Anh & Gia Lam Drainage Block

Gia Lam area would not persist in the additional drainage pumps for the time. Dong Anh area is high in the frequency of inundation, expecting higher project effects.

Trinh Xa & Xuan Vien Drainage Block

This block is moderately good in the present inundation events as compared to the other blocks. The repair/replacement of existing pumps would be required but low in the project feasibility. In either way, the priority should be given to the improvement of the Ngu Huyen Khe River and measurement to the warning water level for suspension of pump operation in the Cau River rather than the drainage improvement for the area.

Tao Khe Creek Drainage Block

This block would be the highest in the economic internal rate of return for the project (EIRR). It is recommended to make plans of separated drainage for Tan Chi area and Combined drainage for Tan Chi and Han Quang area, in the view of the decentralization drainage.

Kim Doi Creek Drainage Block

The Kim Doi area is suggested to improve urgently from a standpoint of solving heavy inundation problem in the upstream area, but the high EIRR estimated from the present inundation damages might be unexpected. Viet Thong area is expected to implement the project with high EIRR urgently.

Chau Cau & Pha Lai Drainage Block

The block hastens to implement the drainage improvement. The EIRR would be high in Chau Cau area but low in Pha Lai area because of the river dike improvement in parallel with the inland drainage improvement.

(3) Selection of Priority Project

Tao Khe creek drainage block is selected as the highest priority in the economic internal rate of return. This drainage block is divided into three (3) sub-drainage areas, for instance, Tan Chi, Han Quang and Hien Luong by Tram and La Miet sluices.

Considering the persistent social problems in the existing drainage control and sluices, it is recommendable to improve drainage systems in each sub-area within Tao Khe creek drainage block in a view point of the phasing development based on decentralization drainage method. The application of this method is expected to mitigate the drainage damages in the downstream area by diverting the runoff discharge at the upstream area in terms of urgency and the scale of the project. Therefore, the scale of the project will be decided depending upon alternative studies on a drainage plan for Tan Chi area and a combined drainage plan for Tan Chi and Han Quang areas as studied in Part II of this report.

B FEASIBILITY STUDY

B-1 The Project Area

(1) Location and Socio-Economic Conditions

The Project Area is an agricultural land area situated in the middle reaches of Tao Khe creek and extended most land area within Tien Son district and some land areas in Que Vo district in Ha Bac province. The area is alluvial, which is overlaid with deposits brought by the sediments of the Red River. The Project Area is divided as follow:

Project Area (ha)

District	Tan Chi Area	Han Quang Area	Total
Tien Son	6,420	1,260	7,680
Que Vo		860	860
Total	6,420	2,120	8,540

The area is near to the capital city of Hanoi having good accessibility, but the improvement of social infrastructures become behind the needs of inhabitants and/or social changes.

The population of the area is 134,650 in 1990 and the population density is 1,577 person/sq.km. The average size of household is 4.42 persons. The mobility of population is still low.

Most of villages in the Project Area have already been electrified. The domestic water is mainly obtained from the hand dug well and many houses are supplementarily using rain water.

(2) Natural Conditions

The area is lowlying flat and poor drainage area. In July to September, maximum daily rainfall occurs and lasts from 2 to 5 days. It's 10 percent probability is 183 mm and that of 3 days consecutive rainfall is 248 mm. Annual mean sunshine hour is 4.4 hours and mean temperature is 24°C.

The major soil groupings in the Project Area are Fluvisols (alluvial soils) and Gleysols (water logged alluvial soils). Fluvisols covering 33 percent of the total agricultural land are acidic, rich in organic matter and very poor in NPK. Gleysols accounting for 53 percent of the agricultural area are acidic, rich in

organic matter and very poor in phosphorus but high content iron. The problems soils (gleysols, plinthosols) of the Project Area are high acidity, P deficiency and associated Fe toxicity.

The Project Area of 8,540 ha of which 5,760 ha is dedicated to agriculture consisting mostly of paddy rice cultivation. About 200 ha of the land in the area is classified as forest land. The remaining other category of land use (2,580 ha) covers urban, rural residential area and others.

(3) Agriculture

Crop

The paddy yield in the area is 3.3 t/ha, nearly same as the national level. The yield of maize (1.9 t/ha) is a little bit higher than the national average (1.6 t/ha), but the cultivation area is decreasing.

One third of villages in the area is cultivating maize. The yield of groundnut is the same as national level (1.0 t/ha). Soybean is an important crop, but is one of declining crops in the area. The yield (0.5 t/ha) is much lower than Ha Bac province's level (0.8 t/ha).

The cropping intensity in the area is 1.9 on an average. About 90 percent of the cropping intensity is covered by paddy. The intensity will increase by short maturation varieties and using more land for subsidiary or short maturation industrial crops under the efficient water management.

Animal Husbandry and Inland Fishery

The average density of ruminants in the area is 1.0 per agricultural land (ha) and that of pig is 4.3.

In terms of inland fishery, there are 167 ha of the pond and small lake of which 147 ha are of use fish culture. Present fish productivity in the area is still very low ranging from 400 to 2,800 kg/ha/year, depending on the stocking rate, pond management technique.

Low fish productivity is also found in irrigation canals at 400 kg/ha. Fish from the pond is sharing about 96 percent and fish from the paddies and irrigation canals sharing only 4 percent.

Agricultural Economy

Farm household economy study in the area has been carried out based on the farm survey. Farming scale is classified into three types.

Small-scale farmer : 40 percent of the total farmhouseholds
average farm size 0.13 ha
farm income 150 \$/year

Medium-scale farmer : 50 percent of the total farmhouseholds
average farm size 0.27 ha
farm income 280 \$/year

Large-scale farmer : 10 percent of the total farmhouseholds
average farm size 0.51 ha
farm income 510 \$/year

Marketing and Processing

Marketing of rice paddy produced in the Project Area is mainly dealing with local merchants. As industrial crops such as groundnut and soybeans are collected by local merchants and large producers in the area.

There are six rural free markets in the area. Administrator of these markets is assigned by district people's committee.

There are two processing factories for farm products produced in the area. Husking capacity of Bac Ninh Factory is 90 tons/day and storage capacity is 4,000 tons for paddy. Ha Bac Oil Factory is only one processing factory in the north Viet Nam. Annual operating capacity of vegetable oil is 3,000 tons and 5,000 tons of extractions (cake).

Agricultural Supporting Service

National and provincial research or experimental organizations related to agriculture and fishery are provided in the neighborhood of the area. The activity of the new organization on agricultural extension has started from 1994 in district level.

Farmer's Organization

All farmers in the area are member of the cooperative who can receive a certain land against such duties, in most of cases, as payment of membership fee of 5,000 VND/annum, land tax of 15,000 VND/sao/annum in minimum but depending on the classification of land, and water fee of 12,000-24,000 VND/annum.

The women's association is the second large organization next to the farmer's cooperative. Women are participating in economic activities including agriculture very positively, and there is many matrilineal families in the Project Area. The activities of women's association is active playing an important role on family planning, improvement of living circumstance.

(4) Irrigation and Drainage Systems

Irrigation System

The irrigation water source for the Project is the Ngu Huyen Khe River, supplementing the water from the Duong River. The water is taken by Trinh Xa pumping station and diverted to the north and south main canals. There are about 19 irrigation pumping stations and 18 dual purpose pumping stations for irrigation and drainage built and operated by the communes and/or villages.

Drainage System

Tan Chi and Han Quang drainage area are separated by the provincial road No. 38 to the west and the east. The excess water in Tan Chi drainage area are collected to the Tao Khe creek and flows down to Han Quang drainage area through Tram sluice in the dry season and discharge to the Duong River by Tan Chi pumping station in the rainy season.

Tan Chi pumping station has been constructed in 1975 with 68 units of pumps, of which eight units have also been used for irrigation. The actual discharge capacity per one unit has been decreased to 75 percent of the reported one.

The Tao Khe creek is disordered in the cross-section and its flow capacity to drain the excess water in Tan Chi area but regulated in its gate opening height. In Han Quang area, no pumping station exists.